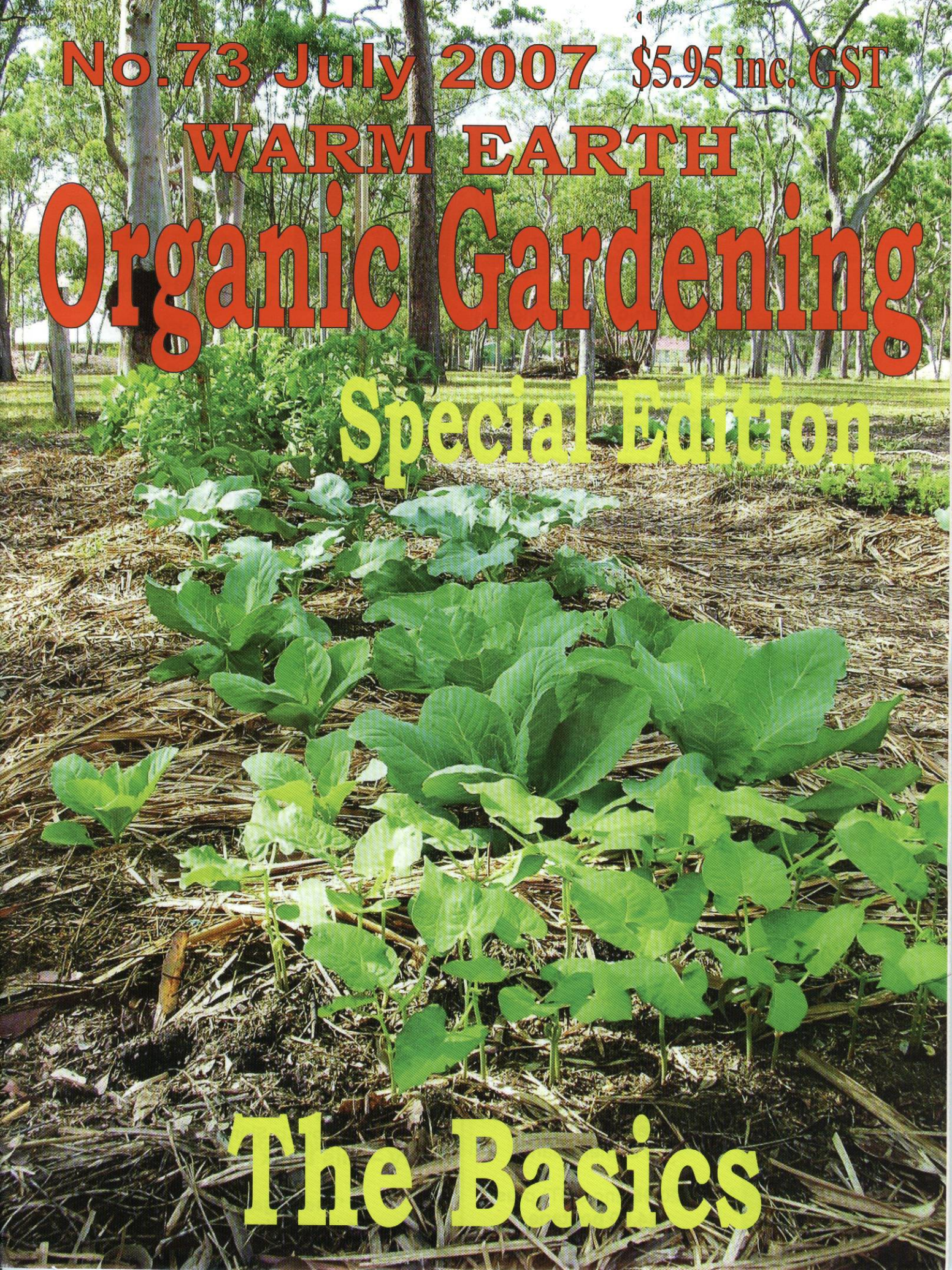
No.73 July 2007 $5.95 inc. GST

WARM EARTH

Organic Gardening

Special Edition



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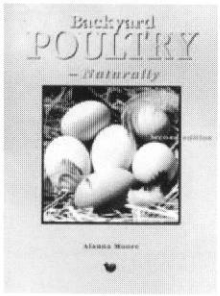

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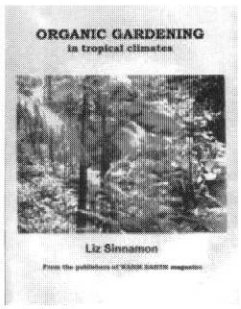

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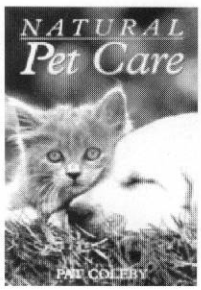

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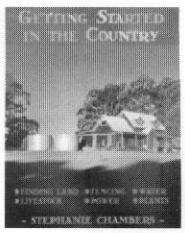

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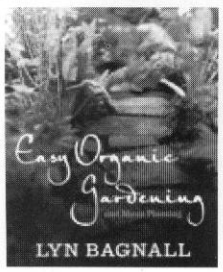

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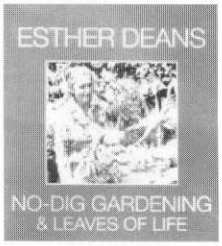

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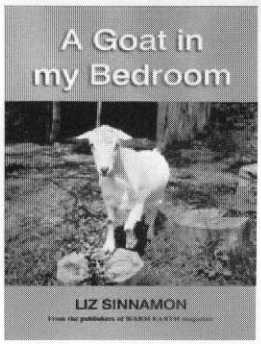

A Goat in my Bedroom
by Liz Sinnamon

Liz's story of her journey from suburban living to a self-sufficient lifestyle on small acreage.

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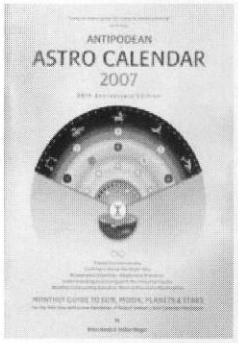

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32 pages

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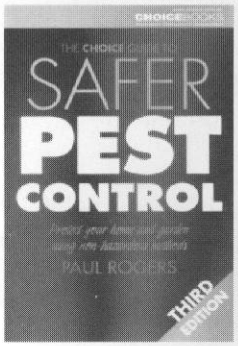

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Growing Fruit, Nuts and Herbs Organically
by Liz Sinnamon

Sorry – this book is now out of print

'The Organic Factor' is currently unavailable

Contents

Number 73

July 2007 ~ August 2007

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Warm Earth Publishing. ABN 67 346 176 220
EDITOR: *Liz Sinnamon*
Front cover Photograph: The Editors vegetable garden.

WARM EARTH is Australia's 'down to earth' organic gardening magazine—written by organic gardeners for organic gardeners. It's all about growing fruit, vegetables, and herbs organically in the home garden or on small acreage.

Learn how to manage poultry and animals, grow native trees and shrubs, ground covers and ornamentals. Find information on health issues and how we can achieve a healthier, happier lifestyle.

WARM EARTH is available from newsagencies throughout Australia.
The middle pages are a liftout section for subscriptions, ordering back issues and seeds, plus **WARM EARTH** books.

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Days in a Country Life....

Dear Readers,

A warm welcome to this special edition of Warm Earth. In this issue we cover all the basic practices of organic growing which we know will help you all with your organic gardening.

It was 1982 when I decided to grow my food organically. This decision led me to undertake a lengthy and in-depth study about the subject—reading every book and magazine available at that time.

Then I put theory into practice and initially was rather surprised when the plants I grew were very healthy and extremely productive. As I continued to grow organically I learnt a great deal by trial and error, and would often experiment with different growing techniques. Some worked, some didn't. Now I can't envisage gardening any other way and have always grown as much of my own food as possible. It is so rewarding to harvest fresh nutritious food straight from the garden.

Here at home, after 12 weeks of very dry weather, the skies opened in early June, and we received over 60 ml of beautiful rain. Rain definitely has a different effect on plants than any other sort of water and the veggies literally jumped out of the ground with joy.

We've had mixed success in the vegetable patch since planting up in early March.

Temperatures during May were above normal with 30 degrees C occurring on a daily basis. The cabbages, caulis, broccoli and silverbeet didn't enjoy the heat at all. Every day their leaves would wilt and they certainly didn't look happy.

The snow peas, beans and lettuce have all grown well, and are producing a good harvest. The Grosse Lisse tomatoes are thriving. and are already loaded with fruit.

Warwick surprised me recently with an unexpected present. He bought me a food drier. I'd often mentioned that I'd like to start drying some of our excess crops, especially the tomatoes. I've never dried food before, so it will be an interesting experience.

The potatoes I planted in early April are growing well and look very healthy. I planted three different varieties putting a thick layer of compost in the bottom of the trench before planting the tubers. The photo on the left was taken four weeks later. I've been hilling them up every week or two and eventually used up all the soil from the original garden bed.

I had a gentle peek in late May to check on the development of the tubers. I discovered plenty of beautiful new potatoes and couldn't resist harvesting a few for dinner. They were absolutely delicious served with a pat of butter and a sprinkling of fresh mint.

I wanted to mulch the strawberries with silver plastic sheeting. This keeps the fruit clean and deters fruit fly. I needed about 4 metres but after trying several suppliers could only buy a roll of 40 metres!

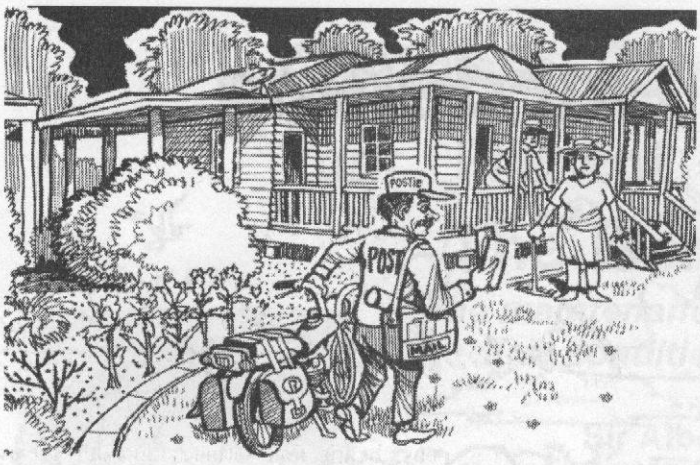
I decided to try black weed matting. After a few weeks I noticed that the strawberries were obviously unhappy, so I pulled it up and mulched them with wood shavings. This seemed to suit them better as they are now thriving and setting their first fruits.

The seedling fruit trees have all established well with the lychee bursting out with sprays of new leaves and the two avocados showing new growth. Have a great winter in the garden……Liz

Tell us your story

If you have a story to tell about how the recent drought-breaking rains affected your garden or property please write and share it with us.

If we receive it before the 20th July, we'll publish it in the September edition.



From our Readers.....

We love receiving letters at Warm Earth please write or email

Dear Warm Earth,

Enclosed please find a cheque for two, 2 year subscriptions. One is a renewal and the other for my mother who is 90 this year, but still in very good health. I know she will enjoy your magazine.

Yours faithfully,
Harold Green,
Beaudesert, Qld.

Dear Liz and Warwick,

Just want to congratulate you on such a great magazine. You have inspired us to get off our backsides and get back into the garden.

With five children to feed, and veggie prices going through the roof, it's about time to take action.

So far we have planted lots of seeds. We don't know where the kids planted everything and it's fun to find beetroot coming up next to the corn.

The kids are enjoying being away from the TV in the afternoon and we're all enjoying playing in the dirt.

Keep up the good work,
Ken and Natalie Hatch,
North Rockhampton, Qld.

Hello,

I would like to subscribe for 12 months. I am an organic farmer and find the magazine very helpful. Keep up the great work.

R. Pollifrone,
Gosford, NSW.

Dear Warm Earth magazine,

I am sending a cheque for a two year subscription.

I subscribed last year for the first time and loved getting my magazine in the mail.

I would like to thank you for such a great magazine. I have read a lot of magazines in my time and yours in the only one I read from start to finish and then read again. There is so much information I can use.

Thanks,
Jayne Bryant,
Virginia, SA.

Dear Liz,

I'd like to order a new subscription plus back copies and planting guides.

I am so happy to have discovered your magazine. In the past friends and family have given me subscriptions to some of the other bigger and better known magazines, but I felt they were not quite attuned to my need for organic gardening information.

You have 're-inspired' me. I got a bit slack this summer due to the heat and water restrictions, although I tell everyone else I was leaving the veggie plot 'fallow'.

Lets hope there's plenty of rain on the way for everyone.

Thanks,
Joanne Sullivan,
Preston West, Vic.

Dear Folk,

Renewal time again—an annual pleasure. Many thanks for your excellent down-to-earth magazine.

So pleased to see you mention Yacon in the May edition.

We were introduced to this excellent and versatile vegetable three years ago. It has to be the ultimate stir-fry veggie.

We would be happy to supply growing material for any interested reader.

Keep up the good work,
Alan Luckman,
33 Richards Drive,
Mophett Vale, SA, 5162.

Dear Liz and Co,

I have just found your magazine (I was looking for something to read in my lunch break).

You wouldn't believe how impressed I was. Thank you for allowing me to have the best lunch break in a long time.

Congratulations and every best wish for continued success with the magazine.

Best wishes,
Sally Koulouris,
New Lambton, NSW.

Dear Warwick and Liz,

I'm really enjoying the back copies of Warm Earth.

After several years of not having a veggie garden, basically because of drought, heat etc., I have been inspired to start one again.

Thanks so much for all the great reading.

Regards,
Jan Seeney,
Monto, Qld.

Organic Gardening

Healthy Soil—Plants—Animals—People—Environment

The term 'organic farming' was first used in a 1940 publication, 'Look to the Land', by Lord Northbourne (London:Dent).

Not just a technique, but a philosophy.

The components of what we now call organic gardening and farming have been practiced for centuries.

Organic Gardening—
Past, Present and Future
The Pioneers

"The maintenance of the fertility of the soil is the first condition of any permanent system of agriculture".

Sir Albert Howard (1873 - 1947)

Sir Albert was the man who started the organic farming and gardening revolution.

His book 'An Agricultural Testament', published in 1943, by Oxford University Press in New York and London was the result of twenty-five years of research in India. Although he was caricatured as a superstitious believer in 'muck and magic', he was in fact a highly distinguished scientist.

Sir Albert spent from 1905 to 1931 in India, and in 1926 was President of the Indian Science Congress. As Director of the Institute of Plant Industry, in the state of Indore, he developed the Indore Process. He applied modern scientific knowledge to ancient techniques of composting, using vegetable, animal and human waste.

Although he was not the earliest critic of modern agriculture, he was the first popular champion of practical organic alternatives. His most biting criticism was directed against 'fragmentation'—the unnatural separation between the soil, crops, livestock, and humans.

He believed these were all part of a natural complexity, and research on each one without reference to the others was highly dangerous. In fact, he believed the dependence of chemical fertilisers, insecticides, and drugs for human ills was directly caused by this fragmentation.

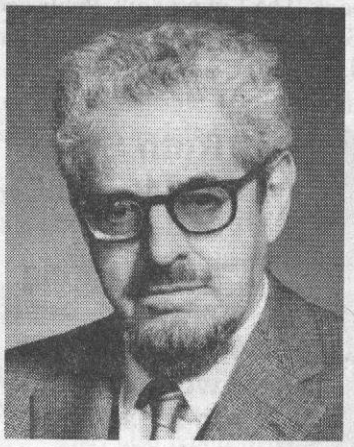
To better control the monsoon rains, he developed a system of contouring and terracing the fields; but the real answer, he found, lay in using native, deep-rooted plants to let air into the soil.

This led him to his first conclusions on soil fertilisation. Sufficient air in the soil, he discovered, permits myriad organisms to release plant foods like the nitrogen supplied by green manures.

Petro-chemical nitrates and phosphates are unnecessary, natural forces doing a much better job.

Following his return to England, he devoted the remainder of his life to perfecting and publicising his ideas of good agriculture.

These were founded on his belief that the only real basis of fertility was the return of all wastes to the soil, and that plant, animal and human health were directly dependent on this regenerative cycle.



Jerome Irving Rodale (1898 - 1971)

The founder of Rodale Press, Inc., J.I. Rodale became known as the world's foremost advocate of organically grown foods and natural food products.

He was publisher and editor of *Organic Gardening & Farming* and *Prevention* magazines. In 1940, Rodale and his wife Anna, purchased a farm in Emmaus and began to implement the theories of Sir Albert Howard.

He published the first edition of *Organic Farming and Gardening*, laying the foundation for broad-based acceptance of the organic movement.

He praised composting, the value of earthworms, stone mulching, companion plants, and the benefits of certain insects. He also became one of the first advocates of the back-to-the-land and self-sufficiency movements in the early 1940s.

Rodale criticized conventional ideas of gardening and large scale agriculture, and warned against the use of chemical fertilisers and pesticides.

Receiving only ridicule from the government and the agricultural industry, JI, in 1947, formed the Soil and Health Foundation, a non-profit research foundation which awards grants to individuals and groups performing research in areas of organic interest.

His lifelong concern with health came to fruition when he published the first issue of *Prevention* in June of 1950. He advocated good diet and the use of natural vitamin and mineral supplements.

He won many converts as he battled the countless governmental bureaucracies on issues related to food processing, artificial additives, pollution of the environment, the evils of sugar, and the low minimum daily requirements for vitamins set by the federal government.

Lady Eve Balfour (1899 - 1990)

"The health of soil, plant, animal and man is one and indivisible."

Lady Eve Balfour was a dynamic leader in the field or organic agriculture in the UK. In 1946 she became the first president of The Soil Association—an organisation that promotes the use of organic means of farming and gardening instead of using chemicals.

She also wrote the book 'The Living Soil', Published in 1975. There are now Soil Associations in 40 different countries around the world.

Ruth Stout (1884 - 1980)

"I love spring anywhere, but if I could choose, I would greet it in a garden."

Ruth Stout was an evangelist for the easy way to garden. She originated the year-round mulched, no-work garden, when she began gardening in the late 1920s and early 1930s.

Ruth was a conventional gardener, but, by thinking for herself and carefully observing the results of her trials, she began to develop methods of her own that often defied gardening 'experts'.

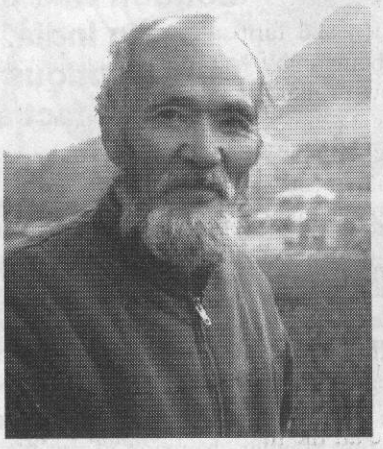
Since about 1943 Ruth used a permanent 20 cm straw mulch. She threw other vegetable matter on the straw—grass clippings, vegetable wastes, stalks from old plants, weeds.

Whenever the mulch begins to thin or weeds grow through this mulch, she added more straw.

As the mulch decays it enriches the soil underneath enough that no compost or fertiliser is required. Ruth pulled the mulch back from the rows, planted her seeds, and when they sprouted, pulled the mulch around the tiny plants.

With this method, composting, tilling and weeding are unnecessary. Ruth eventually found that her soil was so well fertilised by the decaying mulch that she didn't have to thin any crops besides corn and parsnips.

Her method and its results were reported in a series of articles in *Organic Gardening and Farming* (beginning in 1953) and elsewhere, plus in a series of books.



Masanobu Fukuoka of Japan

"The healing of the land and purification of the human spirit is the same process."

Masanobu Fukuoka was born in 1913, of a family that has farmed the southern Japanese islands for over 1,400 years. His well-known book 'One Straw Revolution' was published in 1978 by Rodale Press.

Educated as a microbiologist and soil scientist Mr Fukuoka's specialty was plant pathology and he spent a lot of time in research.

Over 40 years, he observed the Japanese nation abandoning their traditional farming methods and following the American model, both economic and industrial.

He noticed this coincided with degradation of the land and society and so he returned to traditional methods and improved on many of the old ways.

Fukuoka produces citrus and grains including rice. He believes in minimal interference to create a natural balance and that upsetting the balance by using insecticides to destroy pests perpetuates a cycle of imbalance, creating a system permanently dependent on chemicals which results in greater long term insect damage once predators are destroyed.

For people who wonder why they have chosen an ideology of self sufficiency, it is encouraging to read the experiences of someone who has already trodden this arduous path. Masanobu offers words of reason that are simple and uncomplicated. He has also written many other books on natural farming.

The early years

In the early years of what came to be known as the organic movement, growth was slow.

Here and there a few conservation-minded people were impressed with Sir Albert's reasoning and began trying to teach his ideas to others.

Before long garden and farm magazines headed by "organic' editors were being published in the United States, England, Australia, New Zealand, and Germany.

These magazines became the principal method of communication in the organic field, because the usual government channels of education and science were largely closed to those with organic knowledge.

Organic gardening simple when fully understood

Organic gardening is complex, yet quite simple when fully understood. The basis is a healthy 'live' soil, rich in organic matter and natural minerals, and teeming with life. Such a soil will provide all the nutrients that plants need to be healthy and productive. In this healthy state they will also be more resistant to pests and diseases.

Using natural fertilisers and mulches, companion planting, rotation cropping, and the minimal use of even non toxic pesticides, organic gardening works in harmony with natural laws and the wholeness of Nature.

Foliar fertilising with natural products such as fish or seaweed extracts will also help ensure the health of plants.

Saving seed from the plants we grow in our own garden and district, or when buying seed, using old traditional, open pollinated varieties helps to achieve this aim.

Planting native trees and shrubs to attract beneficial insects, establishing a worm farm, making compost from kitchen wastes, spent plants and weeds, are all part of the total organic picture.

To gain a full understanding of the close and intimate connection which all living things have with each other, is an essential tool when gardening organically. Using natural laws, fruit, vegetables, herbs, flowers and all types of plants can be grown very successfully without using herbicides, pesticides or petro-chemical fertilisers.

The present

With new insights into global warming, water shortages and environmental problems, organic gardening is becoming increasingly popular.

Research into the benefits of organic gardening and farming, plus sustainable agriculture is being carried out in many countries around the world, including Australia.

The future

There is a dramatic global shift towards organic/sustainable agricultural systems and it is a significant emerging industry in Australia.

Currently, Australia has more than 2000 certified organic producers, processors and retailers of organic food and fiber products.

They operate in diverse industries, including grains and pulses, horticulture, viticulture, beef and pork, dairy and honey.

The organic market in the United States reached $28.5 billion in 2005 according to Packaged Facts, the publishing division of MarketReserch.com.

They also report that the market for organic fertilisers and non toxic pesticides is $360 million today and could grow to $670 million by 2011.

Scottish farmers now produce enough to meet 70 per cent of the demand for organic food—up from the 35 per cent estimated level in 2002. Scotland plans to double the area of organic agriculture and production by 2007—*Organic News, 2005.*

Low-tech 'sustainable agriculture', shunning chemicals in favour of natural pest control and fertilisers, is pushing up crop yields on poor farms across the world, often by 70 per cent or more. *New Scientist, 3 February 2001.*☒

Soil—The Root of it All

We are only caretakers of our land and to pass this precious resource on to future generations fertile, productive and 'clean' would be the greatest gift of all.

Organic gardening and farming improves 'living soil' with its myriad of microbes and earthworms, rather than *degrading* the soil by saturating it with artificial and toxic chemicals.

Sick plants are attacked by pests, healthy plants live and thrive. In order to have good, healthy, productive plants you must have fertile healthy soil.

A fertile soil is one which retains water, readily releases nutrients to the plants, and drains well. Soil should be porous enough to allow air to circulate around the roots and yet be strong enough to support the plant during growth and maturity.

Soil should be viewed as a living organism—not the sum of a few unrelated and separate parts. When plants are grown conventionally, petro-chemical fertilisers are used to feed the plant directly, which can result in excessive growth and poor cell structure, which in turn can increase attacks by insects.

With organic growing, organic matter and natural minerals in the soil feed the soil micro-flora and worms, which in turn feed the plants by releasing the essential nutrients that the plants need. This gives sustained, regulated growth and strong cell structure.

The most important tool for the novice organic gardener is patience. It will take time for soil fertility to build up and a balanced ecology to develop. Be prepared for insect damage and a few failures in the early stages.

All soil is composed of four parts

1. Inert mineral and organic particles that make up the soil mass and serve as a reservoir of plant foods. These mineral particles contain potassium and phosphorus, as well as many trace minerals such as calcium, magnesium and boron.

2. The teeming bio-portion composed of busy bacteria, algae, fungi, tiny worms, bigger worms, beetles, larvae, bugs and many other live things. These organisms process and decompose the inert mineral and organic particles, thereby feeding the plants.

3. Water. The *field capacity* of a piece of land is the amount of water it can hold without run-off, making it available to plants.

Fifteen percent organic matter in the soil is ideal for a good *field capacity*. The permanent wilting point is the amount of water in the soil when plants can no longer live and die of drought.

4. Air. Soil bacteria, worms, algae, bugs and other soil dwellers need a good supply of air (oxygen) although some microscopic creatures prefer carbon dioxide.

Let's look at different soils

Sandy soil is composed of large irregular particles that permit water to enter between them and pass through so quickly that it dries out rapidly.

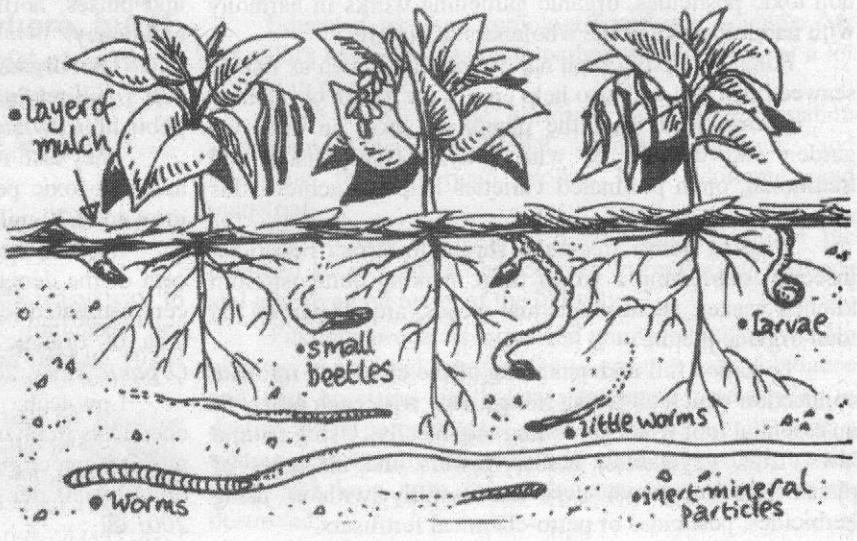
Sandy soils are also quite susceptible to leaching. The addition of large amounts of organic matter is especially important in improving the structure of sandy soils.

Clay soil contains about 40 percent or more clay, less than 45 percent sand and less than 40 percent silt.

A typical clay soil may be composed of approximately 60 percent actual clay, 20 percent sand and 20 percent silt.

Such a soil tends to compact, which makes cultivation difficult and interferes with the oxygen supply for plant roots. It is difficult for water to enter the impervious clay soil and runoff is very common during rainfalls.

Organic matter added to clay soil will make the soil more friable and easier to work.



It will promote a crumbly structure and stabilise soil crumbs so that they are held together under the slaking action of water. As a result, the soil can absorb water more rapidly. Runoff and erosion decline.

Loamy soil

The best type of soil, loam falls somewhere in between clay and sandy. This is known as soil structure. Good soil structure is one that is equally balanced between sand, clay and loam.

This type of soil will permit good drainage while allowing sufficient water retention. It will also help retain soil nutrients while maintaining good aeration of the roots.

Soil must have three important nutrients: they are nitrogen, phosphorous and potassium, plus tiny amounts of trace minerals. All these elements play a key role in the development of a plant.

Nitrogen

Nitrogen is responsible for producing leaf growth and green leaves. A deficiency results in yellow leaves and stunted growth.

An excess of nitrogen produces over-abundant growth of foliage with delayed flowering. The plant is also more susceptible to disease, and bears poorer-quality fruit. Nitrogen-rich organic fertilisers are:

- Poultry manure
- Blood and bone

Nitrogen undergoes many changes when associated with organic matter. Proteins in organic matter are decomposed and finally the nitrogen is changed into a nitrate that higher plants or soil micro-organisms can use.

Legumes also have the ability to fix nitrogen in the soil from the vast quantities of atmospheric nitrogen available.

Poultry manure should be applied at the rate of 33 to 50 kg per nine square metres of garden area.

Phosphorus

All growing plants need phosphorus. It hastens maturity, increases seed yield and fruit development, and increases resistance to disease and the vitamin content of plants. A deficiency can result in stunted growth and seed sterility.

Phosphorus can be added to soil in the form of phosphorus rock. This is a natural rock product containing from 28 to 30 percent phosphorus.

The rock is finely ground and the phosphate is available to the plants as they need it.

Phosphate rock is especially effective in soils containing plenty of organic matter. The bacteria which thrive in such humus-rich soils secrete organic acids that promote the break down and availability of the phosphorus.

Humus forms its acids slowly, releasing nutrients to the plants as they need them.

A natural rock product containing from 25 to 30 percent phosphorus.

Potassium

This third major nutrient is often referred to as potash or potassium oxide. It helps in the formation of carbohydrates and is necessary for photosynthesis.

It also promotes early growth, improves stem strength and contributes to cold hardiness. It also improves the longevity, colour and flavour of fruit. Deficient plants are usually stunted and have poorly developed root systems.

Leaves are usually spotted, curled or mottled and may even appear 'burnt' around the edges.

Most soils contain some potassium but it is bound up in mineral form unavailable to the plants. Organic sources of potassium are plant residues, hay, leaves, woodash and granite dust.

Complete organic fertiliser

All measurements are in terms of volume, not weight.

- 4 parts cotton seed or soya bean meal
- 1/4 part ground mineral fertiliser
- 1/2 part blood and bone
- 1/2 part kelp meal

Trace Minerals

The chemical minerals which plants require in small amounts are called trace elements or minerals, or micro-nutrients.

In all, there are 96 elements known to be essential for plants to grow and reproduce.

The major trace elements are carbon, hydrogen, oxygen, sulphur, calcium, magnesium, boron, manganese, iron, copper, molybdenum, zinc and chlorine.

These can be supplied by using ground mineral rock, also by foliar fertilising with seaweed/fish extracts.

Testing samples of soil

Soil pH

The pH of a soil directly affects the availability of important plant nutrients and is also a significant factor in the growth of both beneficial and pathogenic fungi and bacteria.

Both these factors are of enormous importance to healthy plant growth and productivity.

In soils that are too acidic (below 5.5), phosphorus can become tightly bound to other elements (which prevents it's uptake by plant roots) and other elements such as zinc, copper, cobalt and boron become increasingly soluble and can be toxic to the plant.

In such conditions, pathogenic fungi thrive and friendly bacteria cannot proliferate, which also limits the amount of nitrogen that can be fixed in the soil by the natural nitrogen-fixing process. This results in poorly nourished and disease-ridden plants.

Natural soils in Australia between 4.0 and 5.0

Most natural soils in Australia fall into the range of between 4.0 and 5.0 which is quite acid. This is quite suitable for native trees and shrubs, which have evolved to thrive in acid soils.

However because most popular fruits and vegetables originated in Europe, they prefer a soil pH of between 6.5 and 7.0. Soil testing kits can be purchased from most garden suppliers and come with full instructions on how to use them.

To test soil take several samples from different areas in the garden, mix them together in a plastic bag, and then test.

To correct low pH (acid) soil, apply ground agricultural limestone or dolomite annually at a rate of 2 kilos per 30 square metres of garden area.

Increasing the organic matter in the soil will also help to correct acid soil.

Adding Organic Matter to Soil

Organic matter is a mixture of naturally occurring materials such as plant and animal remains, manures, compost, cover crops (chopped down before seeding and added to the soil), wood ashes and lawn clippings.

Adding organic matter to soil will:

- Improve tilth and structure, plus improve water-holding capacity.
- Help nitrogen fixing.
- Make nutrients available to plants. (Micro-organisms in the soil convert nitrogen in organic matter to 'nitrates' which can readily be used by plants)
- Allow easier root penetration.

Spade over

Spade over the top 7 or 10 cm of soil and fork in the organic matter. This is best done in autumn or early spring.

Leave the soil rough and messy looking

Leave it rough and a bit messy looking. Don't work the soil if it's too wet, this can break down the structure of the soil.

To check soil moisture, a good test is to take a handful of soil and squeeze it into a ball. If the ball breaks apart easily, the soil is ready to work. If it doesn't, the soil is too moist.

It's a good idea to add more organic matter a week or two before you start planting in the spring, even if you have previously added it in the autumn.☒

Organic Weed Control

Weeds are simply plants that happen to be growing where you would rather have something else grow, but there are many weed control options available to the organic gardener.

Mulch: A thick layer of mulch keeps light from reaching weeds. Without adequate light, the plants don't produce enough chlorophyll to enable further growth.

Most of these plants sicken and die before you even notice them. There will be some weeds that do manage to grow up into the light, but they will have very shallow roots and are easy to pull out.

Organic mulches—**straw or lucerne hay, grass clippings, leaves, shredded bark**—nourish the soil as they decompose. They are reasonably effective weed barriers. For even better weed protection, use several sheets of newspaper or even cardboard under these mulches.

Some grasses such as nut grass—is practically impossible to control. It will push through newspaper after a few weeks, although cardboard will control it for several months.

If newsprint and/or cardboard is put down on garden beds in the spring, it should control weeds well into the following winter. The cardboard allows less light to reach weeds and is even more impenetrable.

Hoeing: Annual weeds die when you cut the stems from the roots just below the soil surface.

With a sharp hoe, you can cut the weeds easily. To hoe your garden without cultivating a backache, hold the hoe as you would a broom—that is, with your thumbs pointing up. Skim the sharp sides of the hoe blade through the top 3 cm of the soil.

Solarization: You can let the sun help you get rid of persistent weeds, if you're willing to leave the bed fallow for six weeks during the summer.

Get started in late spring or early summer by pulling, hoeing or raking out as many weeds as you can from the garden bed. Then, moisten the soil and cover it with clear plastic, weighing down or burying the edges. Leave the plastic in place for 6 weeks. When you remove the plastic, the sun will have cooked the weeds and any seeds that would otherwise have sprouted.

Handpulling: Here's the trick to comfortable, quick weed-pulling: Put your hands in front of you, thumbs up and palms facing your body, one hand in front of the other.

Now roll your hands, like kids do when singing 'This old man goes rolling home.' Pinch your forefinger and thumb together as you reach the outermost edge of the imaginary circle your hands are tracing and move your arms to the side as you roll your hands.

With practice, you will be surprised how quickly you can clean up a row in the garden with this movement.

Never hoe or till these plants :

Comfrey, Jerusalem artichoke, Nutgrass

All of these will reproduce from tiny bits of root left in the soil. Chopping them with a hoe or tilling them will break the roots into pieces that will resprout, leaving you with even more of these plants. Instead, pull them by hand and mulch heavily to keep light from reaching any of the roots you miss.

Persistence: This is your most important long-range weapon against weeds. Mulch thicky, pull what you can, hoe where you have to and use a handy tool for a few minutes whenever you visit your garden.

Go for a daily walk in the garden, and pull out the odd weed or two as you go. Do these things consistently for a few seasons, and you will slowly, but surely, expel the invaders for good.

Flame weeder: This is a small propane torch used to get to weeds where other tools do not work, such as along walls or between cracks in a brick or tiled patio. But a flame weeder isn't for burning weeds—merely holding the torch close to the weed desiccates and kills it.

Biodynamic method

The power to reproduce new plants is concentrated in the seeds. This method is similar to homoeopathy as it is an action of smallest entities. Collect the seeds of all the different weeds that need to be eradicated, making sure the seeds are ripe.

Burn in an open area on a small heap of wood. Collect the remaining ashes (wood ash plus burnt seeds) and scatter the ash over the areas where the weeds were growing. This treatment should be repeated each year for four years.

The weeds will return in the first two years, but although the plants may look healthy, the seeds will deteriorate as they begin to ripen. In the third year, very few weeds will grow and after four years of treatment they should have disappeared completely from the treated area.

Bindii: To clear large areas of bindii, cut the plants right down to soil level with a brush cutter. (Plants can't live without leaves). If they begin to grow again, cut them back again. Hand weed any small infestations. Set the mower blades lower when mowing the area.☒

Organic Fertilisers

Fertiliser is a substance that is added to the soil to improve its fertility. A variety of elements and combinations contribute to the fertility of the soil—manures, compost, lime, dolomite, ground mineral rocks and mulch.

A fertile soil contains adequate amounts of the major plant nutrients—nitrogen, phosphorus and potassium, plus sufficient micro-nutrients (sometimes called trace minerals)—zinc., manganese,, boron, iron, sulphur, copper, magnesium, molybdenum, and chlorine. Also required is an abundance of organic matter and humus.

To be fertile, the soil must also have a nearly neutral soil pH together with good structure and drainage. In the organic garden natural fertilisers maintain and contribute to the improvement of all these necessary elements.

Chemical agriculture dictates that fertilisers are only those substances that have measurable quantities of at least one of the major plant nutrients. In the organic garden it is important to follow a much broader and more complex interpretation of soil fertility, one that recognises the roles of organic matter and soil structure.

Unlike gardeners who rely on chemical fertilisers to supply crops with specific nutrients in forms that are water soluble and immediately available, organic gardeners use many different natural materials to maintain overall fertility.

Sources of organic nitrogen

Although none of the sources of organic nitrogen are as high in their nitrogen content as chemical fertiliser, they have many advantages. They release their nitrogen slowly, over long periods of time.

A high-nitrogen organic fertiliser is chicken manure. This can be obtained from your own back-garden chooks, bought in bulk from a commercial chicken farm, or purchased in the form of chicken manure 'pellets'.

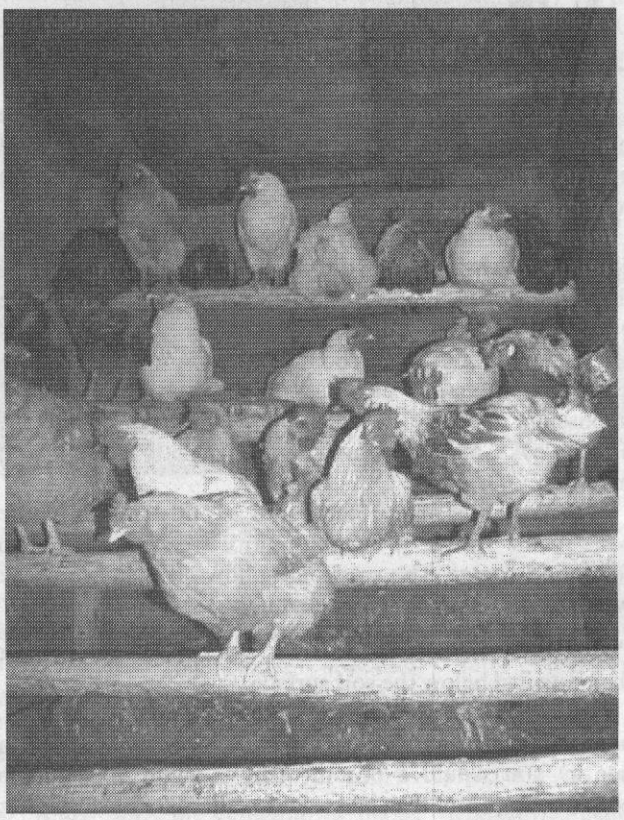
Chicken Manure Pellets

There are two or three brands of pellets available which are certified by organic growing organisations. Look for this certification as your guarantee of a fully organic product.

As the pellets contain concentrated amounts of chicken manure, only small amounts are needed. In the vegetable garden: use 2 kilos (or a full one litre ice-cream container) to every 30 square metres of garden area. For fruit trees use 3 kilos when planting out, 750 grams when applying yearly or half-yearly applications of fertiliser.

Fresh chicken manure

Fresh chicken manure from your own poultry or purchased in bags from a poultry breeder is very high in nitrogen and can burn plant tissues if applied to some plants. It should be mixed with finely chopped grass or straw and applied to garden beds at least four weeks before planting seeds or seedlings. Alternatively add this valuable fertiliser to the compost heap.



Cow Manure

Cow manure contains fairly small amounts of nitrogen—about 10%, 7.5% of potash, and 2.7% of phosphate. It is an excellent organic fertiliser as it will not burn plants and as it contains large amounts of undigested organic matter (grass) it becomes valuable humus when added to soil. It also contains a large population of bacteria. The bacteria in cow manure can make up as much as 30% of its mass.

Fresh cow manure can be added to garden soil without any negative effects. If you are using use dry cow pads, it is sometimes a good idea to put them through a mulcher or run over them a few times with the lawn mower to break them up.

If added to the garden in large pieces, they can take quite a long time to break down into the soil. Bags of pulverised cow manure are now available from garden or farm suppliers.

Horse Manure

Rich in organic matter (grass), horse manure is certainly one of the most valued manures in the organic garden. Before the advent of the motor vehicle, huge quantities of horse manure were available, and was widely used by farmers and gardeners before the petro-chemical era.

Stable manure

Available from horse stables and show grounds, this product contains manure mixed with bedding straw and quantities of urine. Rich in many essential nutrients, stable manure is a magnificent organic fertiliser containing 18% nitrogen (urine is high in nitrogen) 4.5% phosphorus and 13.2% potassium.

It can be added directly to the soil or added to the compost heap. Some medications given to animals will be excreted through the manure or urine, but others are metabolised (broken down) by the animals own systems.

However, medications administered when an animal is ill, such as antibiotics or anti-inflammatory medications, can and do pass through the urine and manure. Composting the manure for a few weeks will break down these substances fairly rapidly.

Blood and Bone

Rich in phosphorus and nitrogen, bones have been used for centuries as a fertiliser. Suitable for all garden plants, including Australian natives, it provides nitrogen for healthy leaf growth and phosphorus for strong root development. Mix with potash for total plant health.

Mushroom Compost

Often available in 10 to 20 kilo bags, mushroom compost consists of approximately 80% straw, wood shavings, horse and fowl manure, 10% gypsum, and 10% limestone.

A by-product of the mushroom growing trade it is rich in organic matter and manures and is excellent both as an organic fertiliser or mulch. As it contains lime, it's best not used for acid-loving plants.

Sugar cane products

The sugar cane industry in Queensland produces large amounts of waste products which are sold as garden fertilisers. Filter mud—the residue left after the sugar has been clarified and ash—boiler ash which is 'scrubbed' from the mill stacks are examples.

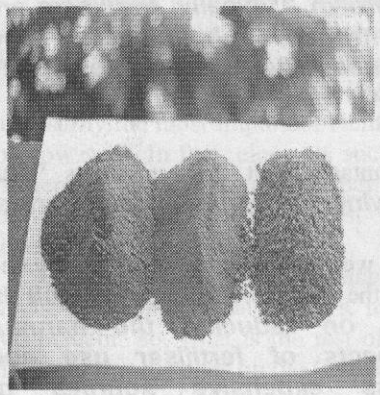
Commercial organic fertilisers

There are several excellent organic fertilisers now available commercially. They can contain chicken manure, sheep manure, seaweed, blood and bone, mushroom compost, and cow manure. Check the ingredients on the bag. Some of these products are already pre-composted and can be used immediately on the garden.

Ground mineral fertiliser

Glaciers and volcanoes are the primary methods nature uses to produce the ground mineral rock. As those methods are extremely slow, mineral fertiliser is added to the soil to supply a broad range of essential minerals.

Mineral rocks are finely ground mineral-rich rocks and are free of any contaminants.



When powdered mineral rock is applied to the soil, microbes in the soil (and earthworms) 'digest' the powder and extract whatever useful elements they find. The plants then extract the mineral rich juices from the microbes.

There are several brands of mineral fertilisers available, with one of the major companies producing several different mineral combinations. Enquire at your local garden or rural supplier.

Lime and dolomite

Lime is seldom thought of as a fertiliser, since most soils contain enough calcium in one compound or another to supply all that plants need.

Garden Lime is used for correcting soil acidity, especially in high rainfall areas where lime may be leached from soils. It aids in the decomposition of organic matter and enables nutrients to become more available to the plant. Dolomite is a type of limestone rich in magnesium and calcium. It is valuable in organic gardens as it adds these trace minerals to the soil as it neutralises soil acidity.☒

What's Wrong with Chemical Fertilisers?

Does it matter where plants get their nutrients? Isn't a nutrient such as nitrogen just nitrogen, no matter where it comes from? Whether the plant takes it up from a previously grown legume crop, from compost or from a synthetic fertiliser, what does it matter?

What would you say to a non-organic gardening friend if you were asked these questions? And what would you make of the following information from a synthetic fertiliser manufacturer's website?

"Fertilisers replace the chemical components that are taken from the soil by growing plants. However, they are also designed to improve the growing potential of soil, and fertilisers can create a better growing environment than natural soil.

They can also be tailored to suit the type of crop that is being grown. Typically, fertilisers are composed of nitrogen, phosphorus, and potassium compounds. They also contain trace elements that improve the growth of plants".

Wow! Isn't it fantastic that these products ***"can create a better growing environment than natural soil"?***

But just when we were thinking of giving up organic growing we read on the same website: ***"research is currently focusing on reducing the harmful environmental impacts of fertiliser use and finding new, less expensive sources of fertilisers".*** Uh-oh, could there be a problem?

Important questions

These are important questions and deserve a serious reply from an organic gardening perspective. Basically, its all a matter of focus. Growers who rely on artificial chemical fertilisers are focussed on the plants. They view soil mainly as a support medium for fertilisers.

An organic grower's focus is on the soil and the surrounding ecosphere. Our philosophy appreciates the natural order of nature and we work in harmony with it, rather than regarding it as inadequate and requiring constant chemical intervention.

The basic principle of organic gardening is this: feed the soil and let the soil feed the plants. Soil is more important than oil in the long run because it is as much a non-renewable resource as oil.

Chemical fertilisers cannot improve soil fertility. Only organic humus will enhance the life in the soil.

Chemical fertilisers can neither add to the humus content of soil nor replace it. When chemical fertilisers are added to the soil they dissolve and seek natural combination with minerals already present. Chemical fertilisers do not work on the soil but are enforcedly imbibed by plants.

'Empty' food

The chemical mixes of most synthetic fertilisers are developed to produce larger and greater yields—without regard for the nutrients that nature designed for producing quality plants. They are quick-acting, short-term growth boosters and are detrimental to the soil in the long term.

Chemical fertilisers provide an 'empty' type of food directly to the plants. This is like the empty calories we get from eating pure refined sugar.

In the organic garden

In the organic garden, microbes in the soil supply a full menu of nutrients to plants. They decompose dead plant and animal residues to humus, combine nitrogen and carbon to prevent nutrient loss, suppress disease, produce plant growth regulators, develop soil structure, tilth, and water penetration/retention, clean up chemical residues,

shift soil pH toward neutral and retrieve nutrients from distant parts of the soil;

Chemical fertilisers destroy beneficial soil life such as earthworms and the micro-organisms essential to the natural chemical processes of good garden soil.

These fertilisers may also contain sulfuric and/or hydrochloric acid, which increases the acidity of the soil significantly.

The change in soil pH can have a ripple effect that not only affects the plant, but living organisms in the soil as well.

Some synthetic fertilisers are so highly soluble that they are often leached away into ground water sources too quickly to benefit the plants significantly.

A type well known for this effect is the NPK 5-10-5 mix, which also can react with deeper levels of clay and create an impervious layer of solids known as 'hardpan'.

Continued use of chemical fertilisers can dramatically reduce the amounts of trace minerals absorbed by plants. It does this by disturbing the natural delivery system that gets the trace minerals to the plants' root hairs.

The green revolution

World population has increased from 2.5 billion in 1950 to around 6 billion today and food supply has kept pace with the expanding numbers.

This has been termed the green revolution and chemical fertilisers are credited with achieving this. Perhaps forty percent of humanity would not be here today if the green revolution had not occurred.

However, some nations have belatedly discovered that the use of chemical fertilisers has many undesirable side effects.

Report from Indian Insitute of Science

A report from the Indian Institute of Science says, "The use of chemical fertilisers and pesticides played a very important role in the first green revolution in our country.

The increased use of chemical fertilisers and pesticides improved the yield and the productivity of the farm produce manifold over the last 3-4 decades.

However, it resulted in overdrawing the micronutrients of soil and increasing the alkalinity of the sub-soil layer in the country.

We have reached the plateau in terms of productivity and yield. The excessive use of the chemical fertilisers and pesticides has seeped into our water bodies and thus contaminated our water reserves".

Many third-world countries have become dependent on synthetic fertilisers to feed their populations.

The cost of importing these fertilisers puts enormous stress on limited national budgets and is seriously holding back economic growth and development.

It is not surprising that these countries are looking at returning to traditional, locally produced natural fertilisers as a priority.

Chemical fertilisers, unlike natural fertilisers such as compost, are manufactured from unrenewable fossil fuels.

It takes the energy from roughly one litre of oil to produce one kilogram of urea. To produce an acre of corn in the USA an input of 350 litres of oil is required; most of which is involved in the manufacture of chemical fertilisers and pesticides.

With future fuel shortages and high prices, market forces will eventually compel all countries to adopt alternatives to synthetic fertilisers.

What are NPK numbers?

Chemical fertilisers and organic fertilisers show their nutrient content with three bold numbers on the package.

These numbers represent three different compounds: Nitrogen, Phosphorous, and Potash (Potassium), which we can also describe with the letters for their chemical symbols N-P-K. The three numbers listed on fertiliser labels correspond to the percentage of these materials found in the fertiliser.

German scientist Justus Von Liebig was responsible for the theory that Nitrogen, Phosphorous, and Potassium levels are the basis for determining healthy plant growth.

However, this theory, which dates to the 1800s, doesn't take into account the dozens of other nutrients and elements that are essential to plant growth.

Nitrogen, Phosphorous, and Potassium are not necessarily the most important elements required for plants to grow well. In fact, elements such as carbon, hydrogen, oxygen, sulfur, magnesium, copper, cobalt, sodium, boron, molybdenum, and zinc are just as important to plant development as N-P-K.

When looking at both organic and chemical fertiliser labels, you'll notice that the NPK numbers don't add up to 100 percent. So, what is the rest of the fertiliser made up of? Well, that depends on the fertiliser.

Chemical fertilisers can have any number of additional ingredients including dirt and sand. These fillers for chemical fertilisers are necessary so that the nutrients aren't so concentrated that they will damage or 'burn' your plants, your skin, and anything else they touch.

Organic fertilisers don't need fillers

Organic fertilisers don't need fillers, as they are made up of a variety of natural components that in one way or another will all benefit your plants.

Organic fertilisers usually have a lower NPK number, but they are long-term soil nourishers, not a quick fix. Therefore, big NPK numbers don't necessarily mean a better fertiliser.

You may not be able to solve all the world's problems by gardening organically in your backyard, but by avoiding chemical fertilisers, at least you will be a part of the solution rather than a part of the problem.☒

Compost— the Cornerstone of Organic Gardening

In the soft warm bosom of a decaying compost heap, a transformation from life to death and back again is taking place. Life is leaving the living plants of yesterday, but in their death these leaves and stalks pass on their vitality to the coming generations of future seasons.

Composting is a natural process that recycles plant materials. Essentially, bacteria and other organisms feast on carbon-rich matter and digest it, producing humus, a rich, stable medium in which plants thrive.

Worked into soils, humus builds soil structure and provides a productive environment for plants and essential soil organisms.

The more technical definition is: composting is the controlled aerobic (oxygen-using) biological decomposition of moist organic (biologically derived carbon-containing) solid matter to produce a soil conditioner.

Over time, tiny microorganisms break down dead and decaying grass, leaves, twigs, paper, sawdust, hay and straw, weeds, wood ashes, human and animal hair, feathers, garden waste, seaweed and kitchen vegetable and fruit waste. Kitchen waste can include coffee grounds, tea leaves, and egg shells.

The primary microorganisms responsible for composting are bacteria, actinomycetes and fungi.

However, algae, mixomycetes (slime molds), viruses, lichens and mycoplasmas are other organisms present in the composting process.

Soil animals, such as protozoa, amoeba, nematodes, earthworms and arthropods, also perform major roles by degrading surface litter, consuming bacteria and assisting in aeration.

Healthier plants

The microbes break down this 'waste' into dark brown, crumbly compost, rich in nutrients. Compost enhances the health of plants and also improves the soil.

It does this by adding humus, which is the main component of finished compost and is essential for creating an ideal soil structure.

Because it is riddled with pores, the humus in compost shelters nutrients and provides an extensive surface area to which nutrients can bond. It actually traps three to five times more nutrients, water, and air than other soil components.

These characteristics also help retain nutrients that could otherwise be leached or eroded away. Adding organic matter to soils reduces the need for additional nutrient applications.

Compost holds soil together, thereby resisting erosion. High in organic matter, compost can help lighten up heavy clay soils to improve drainage and make it easier for roots to grow. Compost will also help sandy soils hold water and retain nutrients that would otherwise drain through the soil. It also increases the soil's permeability to air and water, and helps soil retain moisture during droughts.

Why not just add raw materials directly?

Why not just add raw materials directly to the soil instead of composting them first? Because when nutrients in materials are decomposing slowly, they are not available for use by plants.

Modern methods of composting help speed up and intensify this natural process of decomposition. Also, decaying organic matter can tie up soil nitrogen—an important plant food.

That's why compost is so valuable—it converts organic material into a stablised product that builds soils and releases plant nutrients gradually—like a time-release vitamin pill.

Compost also supplies micronutrients

Compost also supplies the micronutrients that are needed by plants in very small quantities. Iron, iodine, manganese, zinc and others.

These nutrients are released at the rate your plants need them throughout the growing season. Compost can also help modify soil that is either too acidic or too alkaline.

In addition, compost can neutralise various toxins and metals by bonding with them and preventing them from being taken up by plants. It also helps plants to resist disease.

Composting garden waste is preferable to allowing residues to remain in the garden, because plant material left to rot on the ground can provide a place for pests and diseases to over-winter.

A few simple rules

If you follow a few simple rules, you can avoid unpleasant odours and the compost heap won't attract unwanted critters.

Don't add meat scraps or dairy products—they will turn rancid and smell, attracting rodents, pests and maybe the family dog. Don't add pet waste, as this may harbour disease pathogens dangerous to humans.

Avoid adding charcoal ash and large amounts of vegetable oil or grease.

Everything rots

Always remember that everything rots. Whether it takes place in a forest or in a corner of the back garden, compost happens. To achieve a healthy compost heap, ingredients should be added in layers and mixed together.

If you have a large garden, the best idea is to have three compost heaps. One being built up, one decomposing and one in use.

In tropical and sub-tropical areas, compost should be ready to use in three to four months during the cooler months, eight to ten weeks in summer. In cool and temperate climates, compost may tak from five to six months in winter, two to three months during summer.

The warmer the weather, the faster the compost heap will decompose.

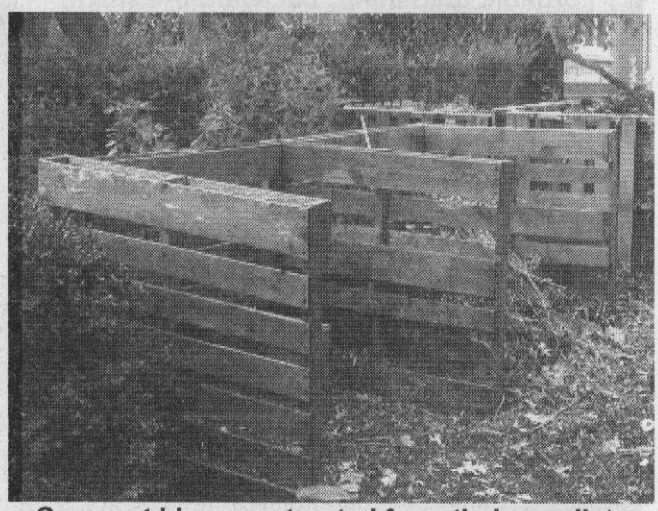
Location

Locate the compost heaps in a convenient area of the garden.

The compost structure should be freestanding and not leaning against a building and it should be placed in an area where there is shade, which will prevent it from over heating in the sun.

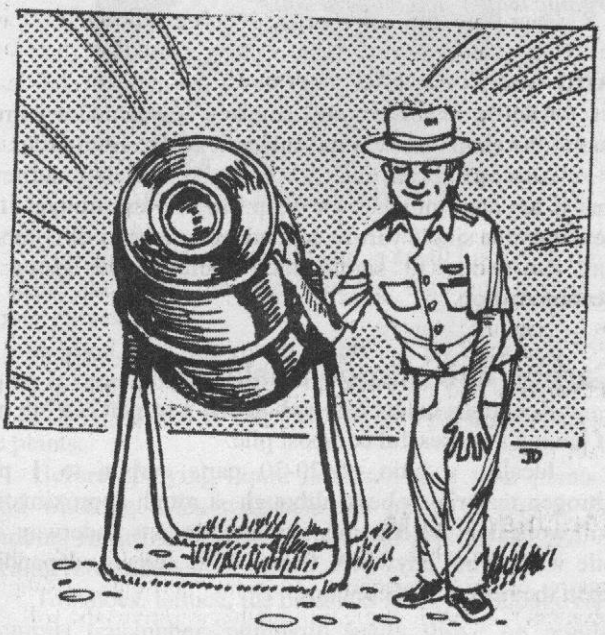
Compost bins

Compost bins can be bought from most major nurseries or garden centres or you can construct your own from brick, wire, corregated iron or timber. Whether you use open or plastic bins, the basic method of making compost is the same.



Compost bins constructed from timber pallets

A simple compost bin made from heavy mesh



A plastic rotating compost bin

Basic compost

Mix together carbon rich material such as dry leaves, with nitrogen rich materials, such as grass clippings. Add a thin layer of garden soil (soil contains microorganisms which speed up decomposition) then add water to keep it slightly damp but not wet.

Turn the heap occasionally to add air—oxygen. If the compost heap isn't turned or mixed it will still decompose, but the process will be a little slower.

Building a compost heap

Spread a 15 cm layer of plant wastes such as hay, straw, spent crops, leaves or woodchips over the ground. Add to this a 5 cm layer of manure or a generous sprinkling of chicken manure pellets. On top of this place a 2 cm layer of garden soil.

Sprinkle on lime or dolomite (about 2 ½ cups) and half this amount of ground mineral rock. Then add a 15 cm layer of green material such as grass clippings, kitchen wastes, weeds and other garden debris. Manure can be added to this layer.

Cover with a thin layer of soil. Continue to build the heap in layers until it's about 1 ½ metres high and keep the heap moist as you build it. Dampen each new layer, any dry materials and the layer of soil. This will help the plant material to rapidly breakdown.

Adding the soil layer immediately after the kitchen wastes will keep odours under control and prevent flies from laying eggs in the rotting material. When the heap has heated up, turn it over occasionally, and cover with a thick layer of mulch.

Earthworms will move into the heap as it cools adding their valuable castings. *Note: Every 24 hours, earthworms eat more than their own weight in dead organic matter and mineral soil.*

Add comfrey and yarrow

Adding some shredded comfrey leaves and a yarrow leaf to the heap will help the compost break down faster.

As a compost activator, comfrey is so rich in nutrients that it not only enriches the heap but also encourages it to heat up. One single yarrow leaf added to a layer of compost has the ability to significantly increase the speed of decomposition.

Carbon and nitrogen balance

Keeping a balance of carbon and nitrogen is a big part of having a successful compost pile.

Ideally, a ratio of 20-30 parts carbon to 1 part nitrogen material is best, although a rough approximation will work fine. As decomposition really gets underway, the pile will shrink anywhere from 20-60 percent, depending upon the materials it contains.

In cold climates

In cold climates, the ideal size of a compost heap would be a minimum of 1.2 metres by 1.2 metres x 1.2 metres to properly insulate the heat of the composting process. If you don't have room for a large pile, a smaller one will work just fine.

Insulate the heap by covering it with a thick layer of straw, hay or leaves. If you don't mind it decomposing at a lower rate, don't bother with the insulation, just wait for the weather to warm up again when decomposition will continue.

When is it ready?

How do you know when the compost heap is ready to use? Finished compost should be crumbly, dark in colour, and should smell sweet and earthy.

The word compost comes from two Latin roots, one meaning 'together' and the other meaning, 'to bring'.

Use on the vegetable garden before planting up. Add the compost to the top 10 cm of soil. Once or twice a year spread compost around fruit trees in a layer about 3 cm thick.

Composting is one of the oldest forms of recycling known to humankind and a natural solution to overflowing landfills and poor soils. When you use compost, you foster a rich and diverse microbial world in your soil, helping to ensure the fertility of the land for next year's garden and for coming generations.☒

Brewing your own Liquid Fertiliser

Home brewing your own liquid fertiliser to use in the garden, is cheap, easy and a great way to give your plants that extra boost of nutrients.

Liquid fertiliser is a great asset for the organic gardener; not only is it a very good plant booster and foliage spray, it can also be used as a form of pest control, (it smells)!

You will need a 45 litre metal or plastic container with a lid to keep out the flies. You can use either animal or bird manure or a combination of both. Half fill a strong hessian bag with manure, and fill the drum with fresh water.

Suspend the bag, (somewhat like a tea bag in a cup of hot water), into the drum so that it's completely covered with water. Give the bag a jiggle every couple of days. During the first week or so it could become a little smelly, so don't put the container to close to the house or the clothesline!

All liquid fertilisers should be ready to use within two to six weeks. When it's ready to use, it should only have a slight odour or none at all.

Comfrey tea

Comfrey makes a nutrient rich liquid fertiliser. Fill a drum half full of comfrey leaves, then top up with fresh water and replace the lid. Leave to steep for about 3 weeks.

Compost tea

Use the same method as when using manure, half filling the hessian bag with good fresh compost. Some of the valuable nutrients in compost will dissolve into the water.

As plants can absorb nutrients in a liquid form, the use of compost tea makes quite a lot of sense, particularly during dry periods when plants are starved for food and water. Many problem plants and trees can be nursed back to health by treating them with compost tea.

You can also use it on bare spots on your lawn and on garden plants, shrubs and trees that have been transplanted.

Compost tea also makes an excellent fertiliser for house plants and young vegetable seedlings.

Seaweed or Seagrass

Products from the sea are low in nitrogen but high in many trace elements. The liquid is also a good foliage spray.

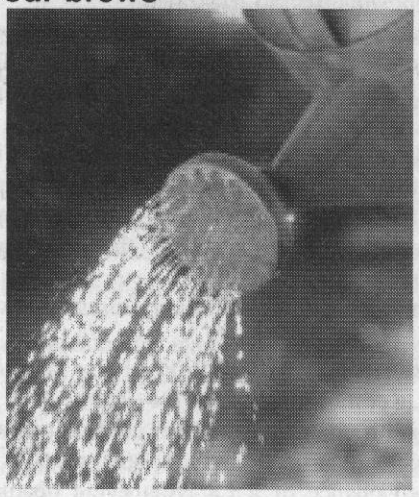
Fill a drum half full of fresh seaweed and then top up with fresh water and replace the lid. Give the brew a good stir every two or three days. Seaweed is also a good soil conditioner, (green seaweed is best), and you can put it straight onto the garden.

Worm castings

The liquid that drains out of a worm farm can be used to make an excellent liquid fertiliser.

This liquid is very rich, and needs to be diluted to 20ml to one litre of water. It can also be used as a foliage spray.

Using your brews



You will need a watering can, a small bucket, a sieve to strain the brew into the watering can, and a pair of rubber gloves.

A good brew for young plants is 25% brew and 75% water. It should be the colour of weak tea. For older plants use 50/50. This is a strong brew so be careful not to burn the plants.

Before applying liquid fertiliser, give your plants a good watering. This will help the plants to absorb the nutrients from the liquid fertiliser and prevent the risk of burning roots and leaves.

Tomatoes, lettuce, the brassicas family, (cabbage etc.) cucurbits (cucumber, pumpkin) really thrive on regular applications of liquid fertiliser.

Don't apply to root crops

Plants that like a little liquid fertiliser when they are beginning to produce their crops are peas, beans, and onions when they are starting to bulb, (not before or they will not store well).

Plants that dislike liquid fertiliser, or any other kind of fertiliser are root crops.

If given applications of fertiliser, they will grow lovely leaves, with spindly and malformed roots. ☒

Is a La Niña Event on it's Way?

By our weather writer—Lindsay Smail, Geelong, Vic.

Hopes for Australia's drought areas to finally shrink—at least for a while—are often associated with a La Niña event. Although such an event is not necessary to end a drought in eastern Australia, there is a slight chance that a La Niña event later this year might just eventuate. If it does, good widespread rains are a very distinct probability.

In Chile signs of La Niña have already started to occur, with widespread concern about developing drought—the opposite effect to Australia.

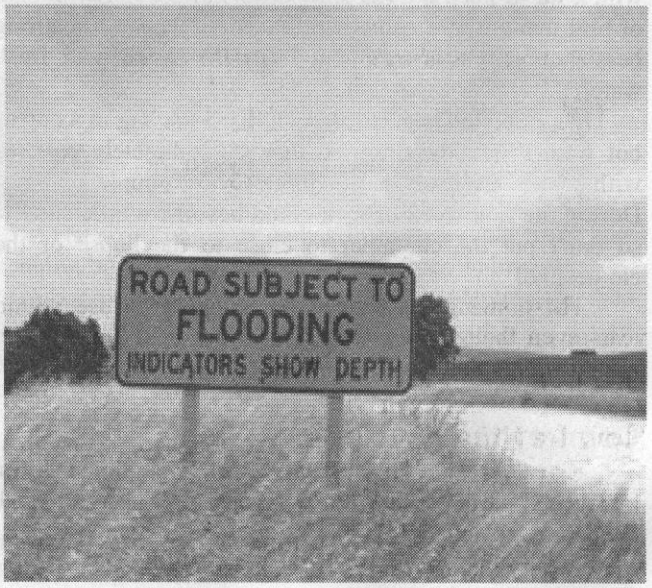
"At the moment we're experiencing the progress of La, Niña which is provoking a rain deficit in Chile's central region", Luis Serrano, of the Chilean Meteorological Authority, said.

Santiago, Chile's capital, is situated in a basin between two Andes mountain ranges that trap pollution, particularly during the Southern Hemisphere winter when high pressure systems suppress the city's already bad ventilation.

In mid-May the Australian Bureau of Meteorology reported:

"These conditions (cooling of the Pacific off South America), combined with the fact that all major international models show further cooling of the equatorial Pacific Ocean over the coming months, suggest that there is an elevated chance of a La Niña event occurring during 2007.

Historically, La Niña events bring wetter than normal conditions across much of the eastern half of Australia from autumn onwards."



What is La Niña?

La Niña can be defined as cooler than normal sea-surface temperatures in the central and eastern tropical Pacific ocean that affect global weather patterns.

La Niña conditions generally occur every few years and can last for as long as two years.

How does La Niña differ from El Niño?

El Niño and La Niña are the opposite ends of a naturally occurring climate cycle sometimes referred to as the El Niño/Southern Oscillation (ENSO).

Both terms refer to large-scale changes in sea-surface temperatures across the eastern tropical Pacific Ocean.

Usually, sea-surface temperature readings off the west coast of South America range from 15 to 20 degrees Celsius, while they exceed 26 degrees C in the 'warm pool' located in the central and western Pacific.

This warm pool expands greatly to cover the tropics during El Niño, but during La Niña, the easterly trade winds strengthen and the cold Humboldt ocean current along the equator and the west coast of South America intensifies.

Sea-surface temperatures along the equator can fall as much as 4 degrees C below normal in a La Niña.

Why do these changes occur?

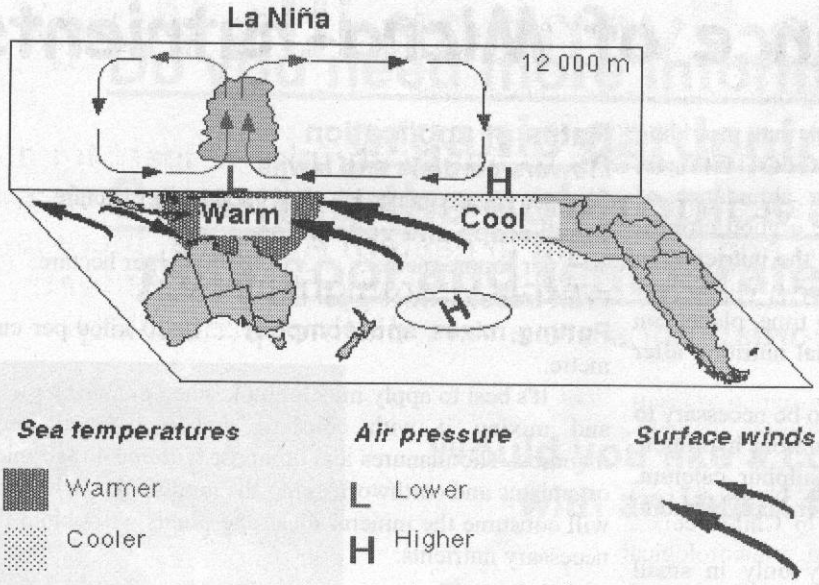
Both El Niño and La Niña result from interaction between the temperature on the surface of the ocean and the atmosphere in the tropical Pacific.

Changes in the ocean temperature and water movements affect the atmosphere and climate patterns around the whole earth. In addition to this, changes in the atmosphere often may affect the ocean temperatures and currents.

The system swings between warm (El Niño), to neutral (normal), or to cold (La Niña) conditions on the average of every 3 to 4 years.

As to what causes the swings to begin in the first place, no-one knows. There are theories about variations in the earth's orbit, in the sun's radiation, in underwater volcanoes and so on.

One thing is absolutely certain—they are not caused by climate change nor do they signify climate change.



These swings have been occurring for thousands of years even though they have only been identified for the past 30 years or so.

How La Niña develops

Usually, a La Niña is preceded by an increase in cooler-than-normal subsurface waters in the tropical Pacific.

Atmospheric and oceanic waves moving eastwards help bring the colder water to the surface through a series of processes still not understood by scientists.

Generally a high pressure centre develops over the cooler waters near South America and a low develops over tropical Australia, thus helping to form the circulation.

After a few months, the easterly trade winds strengthen and cold water begins to come closer to the surface off Peru and Ecuador.

This process of rising cooler water is known as "upwelling" and sea-surface temperatures (SSTs) drop below normal.

During the 1988- 89 La Niña, SSTs fell to as much as 4 degrees C below normal. Both La Niña and El Niña conditions tend to peak during the Southern Hemisphere summer, although they may begin much earlier.

Effects of La Niña

Both El Niño and La Niña have effects on world climate patterns. In many places, especially in the tropics, La Niña (or cold episodes) produces the opposite climate variations from El Niño.

For instance, parts of Australia and Indonesia are prone to drought during El Niño, but are typically wetter than normal during La Niña.

During a La Nina, the cold ocean current flows northwards along the South American coast towards the equator. As the colder water reaches equatorial regions it begins to warm slowly while flowing westwards towards Australia.

Surface temperature increases

The surface temperature of the Pacific then increases several degrees, providing a good environment for a warmer air temperature to develop.

This warmer air above the current is then capable of holding a lot more water vapour than cooler air and is available to flow over the eastern part of Australia as it is pulled southwards by the East Australian ocean current.

The anti-clockwise movement of the ocean currents in the South Pacific Ocean is caused by the rotation of the earth.

It is complicated by many factors including the large expanse of water available and the spherical nature of the planet.

If it were not for those complicating factors our weather and climate patterns would be more constant and very boring. ☒

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The Importance of Micro-nutrients

In the past, it was commonly thought that providing large amounts of the major plant foods, nitrogen, phosphorous or potash, or even an abundance of nitrogen, would automatically produce a good crop. It is now known that growth is regulated by the nutrients in least supply, rather than those in abundance.

Even when well fertilised at planting time, plants can gradually move into conditions of marginal nutrition after sixty days of growth or even earlier.

Although there are sixty elements known to be necessary to plants, the seventeen main elements are carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, sulphur, calcium, magnesium, boron, manganese, iron, copper, molybdenum, boron, zinc, and chlorine.

These plant nutrients are necessary only in small amounts, and are known as micro-nutrients. Of these, all but carbon, hydrogen and oxygen must be provided through the medium of the soil. An excessive amount of any micro-nutrient can cause toxic conditions in plants and sickness in animals and people.

There are two ways to supply plants with these essential trace elements—mineral-rock fertilisers and regular foliar fertilising with seaweed/fish extracts.

Mineral-rock fertilisers

A soil rich in minerals is part of the whole picture of a 'live soil'. Billions of microbes flourish, feasting on the mineral elements, which in turn supply the plants, worms and ultimately us. Five thousand years ago, most soils had an abundance of minerals. Now, after thousands of years of leaching, erosion, farming and overgrazing, plus more recent assaults with petro-chemical fertilisers, soils are a mere shadow of what they once were.

Finely ground mineral-rich rocks applied to soil can restore soils by supplying a broad range of minerals. Powdered rocks and gravels are Nature's fertiliser. Glaciers and volcanoes are the primary methods nature uses to produce ground mineral rock. (Soils around dormant volcanoes are the richest in the world).

When powdered mineral rock is applied to the soil, a marvellous thing happens. The microbes in the soil (and in the gut of earthworms), digest the powder, and extract whatever useful elements they find. Plants then extract the mineral rich juices from those microbes.

The problem with chemical fertilisers, manures and even rich compost is that they may release too much of some nutrients and not enough of others—particularly the important trace minerals.

Ground mineral rock is practically insoluble, so there is little chance of an imbalance developing. Ground water, streams and rivers are not polluted—another important benefit to our environment.

Rates of application

Flowers gardens and lawns

20 g per square metre.....200 kg per hectare.

Small crops and vegetables

30 g per square metre.....300/500 kg per hectare.

Fruit trees.....10 g per tree

Potting mixes and compost.....10/20 kilos per cubic metre.

It's best to apply mineral rock when preparing the soil and mixing it with compost and well-rotted animal manures. The manures and compost will encourage micro-organisms and earthworms into the garden plot, where they will consume the mineral rock, and plants will obtain their necessary nutrients.

Foliar fertilising

Trace minerals can also be supplied to plants by foliar application. This method supplies plants with tiny amounts of micro-nutrients necessary for optimum health.

Plants have a remarkable ability to absorb nutrients through their leaves as well as their roots. Foliar fertilisation of plants will give an immediate response, whereas ground mineral rocks may take some time to be absorbed. An excellent foliar fertiliser is a combination of 75 percent fish emulsion and 25 percent seaweed extract.

This mixture will supply plants with all necessary trace minerals essential for strong growth and plant health.

Sub-tropical and tropical areas

Seaweed extract is best used alone in sub-tropical and tropical areas, as it also helps to control the moulds and mildews so prevalent in the hot, humid areas of Australia.

Seaweed extract contains over twenty-one trace minerals. It also contains cytokinins; which are natural plant hormones which stimulate the growth hormones of plants resulting in improved growth and flowering.

It will also improve the formation of vitamins in fruit and vegetables. Other benefits of foliar fertilisation include increased frost and drought resistance and assistance in fruit set. Apply to the roots and leaves of newly transplanted seedlings to assist with transplant shock.

Apply to vegetables just prior to and after flowering, to assist the plant to produce good sized and healthy fruit. Always apply to plant foliage after 4 pm unless it is a cloudy day. Plants have small openings in their leaves called stomata, which close up in bright sunlight to prevent moisture loss. In late afternoon and during the night hours the stomata open, enabling them to receive and absorb foliar nutrients. These nutrients will be absorbed by plants in approximately two hours. ☒

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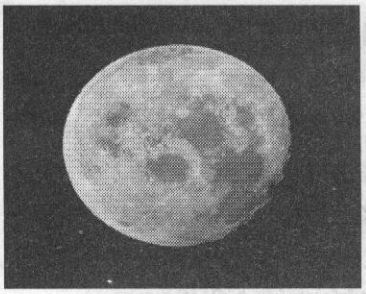


Gardening by the Moon

Pliny the Elder did it, and so did your great grandparents. They planted gardens by the phases of the moon, using a method practiced in rural communities for over two thousand years.

It was so well established in the first century AD that it became part of the 'natural history' that Pliny wrote about in his series of the same name.

A method proven successful over that length of time deserves more than a label of folklore. It deserves a trial in our gardens too.

Superior gardens are what gardeners want for their efforts, and planting by the phases of the moon makes this possible. Seeds germinate faster. Plants are hardier and more disease-resistant.

They blossom sooner and bear more fruit. Just as importantly, they are better able to resist the stress of harsh weather, drought and insect infestation.

Naturally, good gardening techniques must still be followed. Gardens need to be watered, pruned, mulched, hoed, weeded and fertilised. Paying attention to the moon phases may be the easiest part of our gardening experience, but one with the biggest rewards.

What are the Moon's phases?

If we plant by the phases of the moon, we first need to identify them correctly. The most obvious way is to look at the night sky. As the moon cycles around the earth and the earth around the sun its position relative to the other bodies changes. The four resulting moon phases are called 'quarters'.

The moon is 'new' when it comes directly between the earth and the sun and can't reflect much of the sun's light. A 'new' moon cannot be seen from the earth. It is too close to the sun in the sky and only the dark side is facing us.

At 'First Quarter' we see half of the moon. It rises around midday and sets around midnight. A 'Full Moon' rises at sunset and sets at sunrise. We see the entire sunlit side. At 'last' or 'Third Quarter' we see half the moon. It rises about midnight and sets around midday. The light of the moon increases each night until it reaches the 'Full Moon' stage. When the moon decreases from 'Full Moon' back to the 'New Moon' phase, it looks exactly the opposite of a 'First Quarter' moon.

Cycles of the sun, moon and earth

When our rural ancestors planted by the phases of the moon, they were not acting out of ignorance or superstition. They were making a deliberate attempt to align their actions with the natural cycles of the earth.

We do this today with solar cycles. The sun's movement in relationship to earth establishes the primary natural cycle we're most familiar with.

The first thing gardeners in the Southern Hemisphere learn is to plant tender crops after the last average frost date. This date depends on the annual cycle of the sun north and south of the equator.

The waxing and waning moon

Although the sun's cycle is primary, considering the phases of the moon can further refine planting dates. The goal is to plant in harmony with these phases so crops will thrive. Different types of crops are planted at varying times because of their affinity with a certain phase.

Crops that set their edible crops above the ground are connected to the moon's increase in size from 'New Moon' to 'Full Moon' (the waxing period) because the moon is growing 'up'.

Crops with the edible part growing below the ground are related to the phase between the 'Full Moon' and 'New Moon' when the circle of light diminishes or grows 'down', (the waning period).

There is a further refinement of this method that considers the quarters of the moon as well. Experienced moon phase gardeners have found each quarter phase is connected with the following kinds of plants and activities.

First quarter moon

Plants that produce their seeds on the outside, such as lettuce, broccoli, annual flowers and herbs have an affinity with this quarter of the moon. Sow and transplant them during this phase.

Second quarter moon

Plants that set seeds inside a pod or skin do best when planted in this quarter. These are primarily vegetables such as beans, tomatoes, squash and cucumbers.

Third quarter moon

All vegetable root crops such as potatoes, onions, carrots, radishes and beetroot do best planted in this phase. Perennial flowers, flower bulbs, shrubs and trees also prefer the third quarter.

Fourth quarter moon

This phase is reserved for garden clean up. This is the best time to pull weeds. As you plan your garden this year consider timing your plantings by the phases of the moon.

Once you see the great results, you'll know why centuries of gardeners swore by this method. ☒

Mulching

Many people think that mulching in the garden is a new idea, but nothing could be further from the truth. Nature has been the grand exponent of mulching....forever!

Everything that grows, every limb and leaf, from forest giant to tiny moss, every last feather and bone, fur, gristle, from the massive to the minute, all eventually returns to the surface of the soil as the biomass.

This vast, diverse and abundant biomass of organic material is the natural mulch of Nature. We but copy Nature's success story.

There is nothing complicated about mulching in the garden. A few simple basics to understand and anyone can do it.

Mulching a basic practice

Mulching, like composting, is a basic practice of organic gardeners. Nature hates bare earth and will cover it as quickly as possible to conserve the soil.

Have you ever noticed how a bare patch in the garden becomes quickly covered with weeds and grasses?

Mulching offers several advantages. For example, a mulched plant is not subjected to the extremes of temperature that affect an exposed plant. Mulch keeps the soil warmer in winter and cooler in summer.

Finished with weeding

When you mulch your garden properly, you have also finished with weeding. Only the odd weed here and there will manage to get a foothold and can be pulled out easily.

Let's look at a few basics. First, never dig mulch into the soil. All mulch is laid on top of the soil and slowly breaks down as the aerobic micro-organisms chew into it. Aerobic means oxygen-needing.

The soil life at the surface of the soil and in the top few centimetres, consume the mulch for their regular meals.

Another basic—compost is not really a mulch. Compost is a perfect soil ready for plant life to take the nutrients from it.

Mulch is in a raw state and it is not until the soil life turns it into compost within the soil that it is ready to release and share its nutrients.

Anything that has once been alive can be returned to the soil

Another basic—anything that has once been alive can be returned to the soil. However this does not mean that it is all good as garden mulch.

Just imagine a garden mulched in fish heads and abattoir waste—phew! Okay, I'm joking a little but using an extreme does illustrate a point.

It's best to exercise care and sensibility in what you choose to use as a mulch.

Two basic types of mulch

There are two basic types of mulch—one is called a cover mulch, and the other is a feeder mulch. They are very different.

Cover mulch

A good example of a cover mulch is wood chips, pine bark and the like. They cover the ground keeping it cool and moist and they will last for years. But they won't feed the soil in any real or significant way.

A cover mulch is good for shrubs and trees, both native and exotic, in those areas of the garden that are usually in a permanent state.

A garden mulched with wood chips

Feeder mulch

A feeder mulch is quite different. This not only covers the soil, but it also feeds the soil life.

It can be applied all over the garden—around shrubs, trees, roses, flowers plants and vegetables.

A feeder mulch is the most efficient for labour saving, is time and cost effective, saves your back and is a healthy way to garden. So what is a feeder mulch? Luckily, there are plenty of them.

- Grass clippings
- Straw or hay: these can be wheat, barley or pea straw or lucerne. Pea straw and lucerne contain more nutrients but are more expensive
- Sugar cane mulch
- Mushroom compost

Spent mushroom compost is the residual waste generated by the mushroom production industry. It is readily available and consists of a combination of wheat straw, blood and bone, horse manure and agricultural limestone composted together.

Although much of its nitrogen content will have been used up by the mushroom crop, it is an excellent source of general nutrients. It is however an alkaline product and shouldn't be used around acid-loving plants.

A combination of mushroom compost, covered with either sugar cane mulch, straw or hay would be a very effective feeder mulch. Mushroom compost will quickly break down to feed the soil.

Rough grass hay is equally as good as sugar cane mulch or wheat or barley straw.

The coarser mulches are much slower to break down than mushroom compost, and will cover and feed the soil for six months to a year depending on your soil type and local conditions.

Mulch the garden liberally

Mushroom compost gives the soil a real boost and can create a wonderfully rich soil with countless numbers of earthworms, and it will all occur naturally.

The top layer of mulch will last for two or three seasons, keeping the soil cool throughout the summer and protecting it from erosion and heavy rain damage.

The number one rule

The number one rule of mulching is to mulch deeply. Mulch should be at least 20 centimetres deep. A thin scattering of mulch is not only practically useless, it will promote weeds rather than prevent them.

The following table give an idea of the Carbon/Nitrogen ratio of mulches.

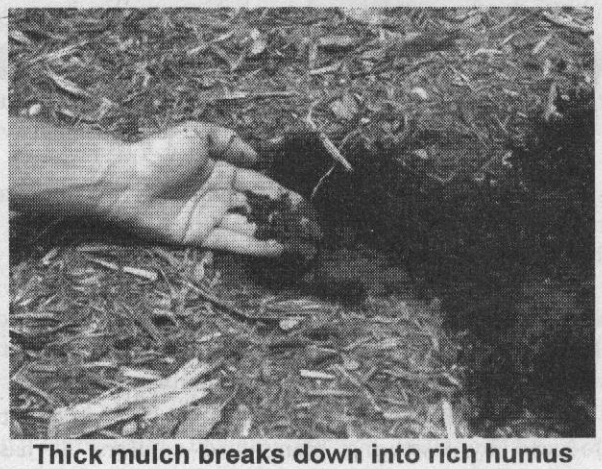
The **C** is carbon, **N** is nitrogen. The C/N ratio of perfect soil is approximately 12 parts C to 1 part N.

Material	Carbon	Nitrogen
Compost	12	1
Green legumes	12	1
Rotted manure	20	1
Legume hay	20	1
Fresh manure	33	1
Soft plant debris	36	1
Straw	80	1
Wood chips	400	1
Pine bark	400	1
Sawdust or wood shavings	400	1

You can see by this table that everything down to straw are all effective feeder mulches for garden soil.

The wood based mulches are so high in carbon that they not only take years to breakdown, they can also rob the soil of its precious nitrogen content.

Remember the closer to 12 parts carbon, 1 part nitrogen you can get, the better it is for your soil. This scale is of course an approximation, as conditions of growth and climate can vary the C/N ratio, but not enough to matter.



Thick mulch breaks down into rich humus

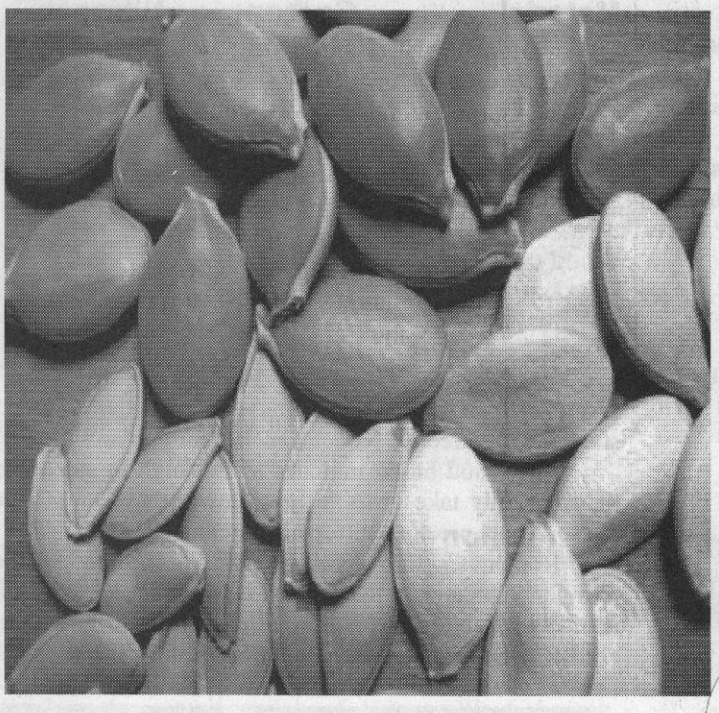
In sub-tropical and tropical areas of Australia, weeds can be completely controlled by the following method.

At the start of spring, scatter some compost and chicken manure pellets over the surface of the soil around plants, shrubs and bushes.

Lay several sheets of newspaper over this, overlapping the edges. Cover with a 20 cm layer of straw or dried grass clippings. You shouldn't have to weed right through summer. If using grass clippings, make sure they are dry before applying as mulch. If put down damp or wet, they can form a thick thatch that is impenetrable to water.

Mulch your garden generously and liberally and always keep it mulched. The condition of your soil will improve dramatically.

Clay soils will open, creating better drainage with water retention, while sandy soils will close through the generation of humus, retaining the precious moisture. Nature has it all worked out, so you can't lose.☒



Seeds— Embryos of New Life

The qualities, characteristics and forms of seeds produced by plants vary greatly according to species, variety and environment.
Some seeds are ready to germinate right after they are produced, while others need a period of dormancy or a period of cold before they will grow.

Without doubt there are more plants raised for our gardens from seed than by any other method. Annuals and vegetables are almost exclusively propagated in this way.

There are three main advantages in raising plants from seed. Firstly, seed is a relatively cheap way of obtaining large numbers of plants.

Secondly, good seed has less chance of carrying disease than vegetatively-produced plants, and thirdly, plants raised in the environment in which they will mature will be stronger and more tolerant than imported plants.

A seed is a very efficient reproductive structure produced by flowering plants and conifers. It has a protective coat and contains an embryo of a new plant and very often a food that nourishes the embryo after germination.

The endosperm or food storage area of seeds also nourishes the seedlings.

The embryo is formed after pollination of the female gamete, or egg, in the ovule by the gamete from the pollen grain.

When the fertilised ovule develops, it is usually encased in a fruit or pod, though seeds of conifers are naked. After fertilisation, the seed itself remains more or less dormant until conditions of moisture and warmth promote germination.

When a dry seed is given water, its colloids take up the moisture and soften the seed coat, often in a matter of hours, although sometimes it may take quite a few days.

The enzymes in the protein system become active, and increase the metabolism rate in the cells. New energy becomes available for further development.

Water uptake and respiration continue while new materials for growth are being synthesised as the enzymes reduce the fats, proteins and carbohydrates stored in the seed to simpler compounds.

Stock seed

Stock seed is the term used by companies that provide foundation seed to contracted growers who in turn produce more seed for the companies.

The seed companies maintain strict standards and supervise the fields of the individual contractors during the season.

Many high-grade seeds are hybrid cultivars, produced by the repeated crossing of two or more lines of parentage. This is accomplished by using inbred lines of seeds or by asexual propagation.

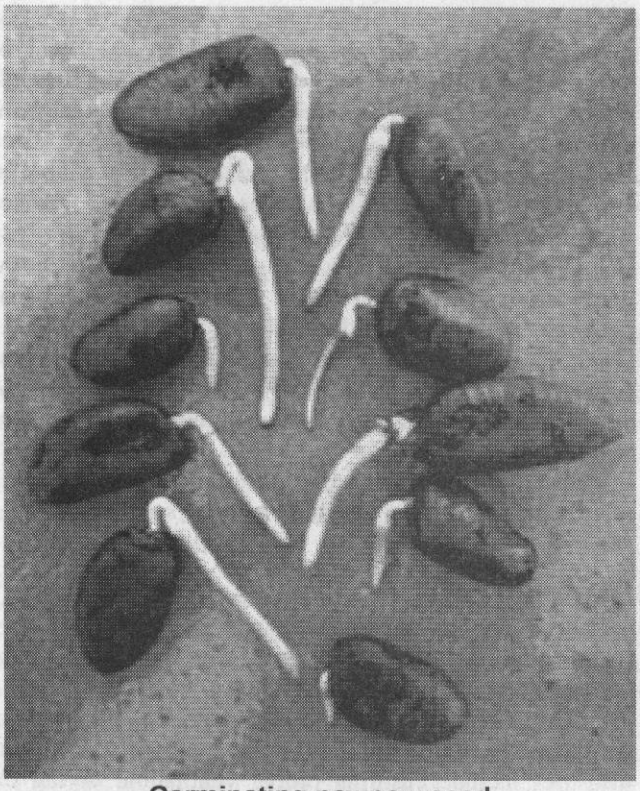
Seed and seedlings

The qualities, characteristics and forms of the seeds produced by plants vary greatly according to species or variety and environment.

Some seeds are ready to germinate right after they are produced and others need a period of dormancy or a period of cold before they will grow. Some grow quickly and some take a long time to reach maturity.

The way you harvest seed important

The way you harvest, ripen and store seeds depends upon germination requirements and the factors that influence the dormancy of each type of seed.



Germinating pawpaw seed

For example, some seeds, including many tree seeds, must never be allowed to dry out before planting. For shipping, these seeds should be collected as soon as they are ripe and carefully packed so they cannot dry out.

Most other seeds need to be stored in a dry, dark place but may require scarring or a special cold treatment before they will break dormancy and germinate.

Dormancy

There are several reasons why a seed remains dormant. Some, such as those of walnut, olive, peach, and plum, plus many flowers and shrubs, have very hard coats which must be injured before they begin to absorb water and germinate.

In nature, natural weathering will scarify the seeds, but the gardener or grower must do it himself by tapping them with a hammer, filing them or rubbing them with sandpaper.

Certain tropical and desert seeds have an inhibitor in the seed coat and must rest until weather conditions develop which can break down the inhibitor.

Seeds of some palms and orchids have embryos so tiny that they must have a quiescent period before they are able to germinate. Other seeds have a rather short period of so-called internal dormancy while they are drying out after being freshly harvested.

The dry storage breaks this dormancy, which is a shallow one compared to the deep dormancy of winter-dormant seeds.

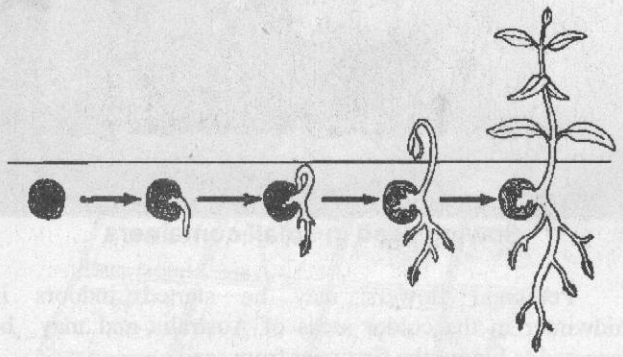
Deep dormancy requires long periods of moisture and chilling. Kept in the refrigerator, these seeds are planted during the summer, kept moist, and allowed their cold dormancy during the following winter.

To stratify seeds in the refrigerator, mix the seeds with slightly moistened sand, peat moss or sphagnum moss, or a mixture of sand and moss or sand and vermiculite. Store them in polyethylene bags.

After a spell in the refrigerator at around five degrees C, watch for the beginnings of germination and when you see the seeds are starting to grow, bring them out and sprinkle them on flats, adding a little water daily so they will stay moist.

Three months is the usual storage time needed for fruits like cherries, currants and gooseberries.

Germination



Stages of seed germination

Too much or too little water at the time of germination affects seeds. Celery, for example, needs a great deal of water, but spinach does not.

Other seeds that don't need much water, although it won't harm them, include cabbage, turnip, sweet corn, cucumber, onion, carrot, tomato and many herbs. Those needing quite a bit more are beans, peas, beetroot, and lettuce.

Of course other conditions and the natural longevity of seeds also contribute to the success of germination.

Onions are only considered to be viable for a year, along with leeks, parsnips and corn; whereas pea, bean, cabbage, and cauliflower seeds will last for three years, and melons up to seven years.

Be sure to inspect seeds received or saved to make sure they are clean, all of one kind, uniform in size, and plump and fresh looking.

If in doubt, put the seeds through a germination test by scattering a specific number of seeds between two damp towels.

Place them in a warm, dark place and, after the required germination period, count how many have sprouted. If it is less than 50 percent, consider using other seed.

Sowing

Hardy and quick-growing annual flowers and vegetables are usually started in beds in the garden.

More tender plants, slow-growing plants, those which take a long time to germinate, and those with seed so fine that weeks are required to develop the seedlings into manageable plants, are usually planted indoors.

Sowing seed in small containers

Perennial flowers may be started indoors in midwinter in the colder areas of Australia and may be expected to bloom the first year from seed.

They may also be sown in spring, in a special outdoor nursery bed and then transplanted in autumn to their permanent garden positions.

Biennials may be planted out anytime from spring to autumn. For early vegetables, seed may be sown indoors and the plants hardened in a sheltered place outside before they are set in the garden.

Vegetables such as cucumbers and squash, normally planted directly in the garden, may also be sown inside in pots or paper containers.

At the normal time for planting in the garden, if all danger of frost has passed, these early plants may be set out without disturbing their roots.

Seeds planted outside are usually planted in the soil in which they will grow during the entire season. The soil must be properly prepared in advance, by adding manure and compost or whatever that particular vegetable or flower needs.

If the seed is to be planted in rows, a drill or trench may be made by using the edge of a board to keep the row straight.

Depth of planting depends upon the size of the seed, the consistency of the soil and the season of the year.

The usual rule is to plant a seed at a depth that is three or four times the size of its diameter.

This rule is modified by soil. Heavy clay soils hold more moisture so seeds need not be planted as deeply.

Sandy soil will dry out faster at the top, so the seed may need to be planted deeper. Seed should never be overwatered during germination, nor should it be kept too cold. If the soil is heavy and wet, it will be cold beneath the surface early in spring.

Seed will germinate more rapidly if it is sown on the surface. When the soil is warmer, seed can be planted further down.

Since seeds need air as well as water during germination, the soil should be granular so that air may penetrate to the depth of the seeds so they can breathe.

Fine seed should be sprinkled on top of the soil and firmed with a board, the back of a hoe or with the hand. A very slight sifting of sand or fine compost over the seed will help keep it moist.

Sand will also help to control damping-off and will rebuff slugs and snails, which love young seedlings.

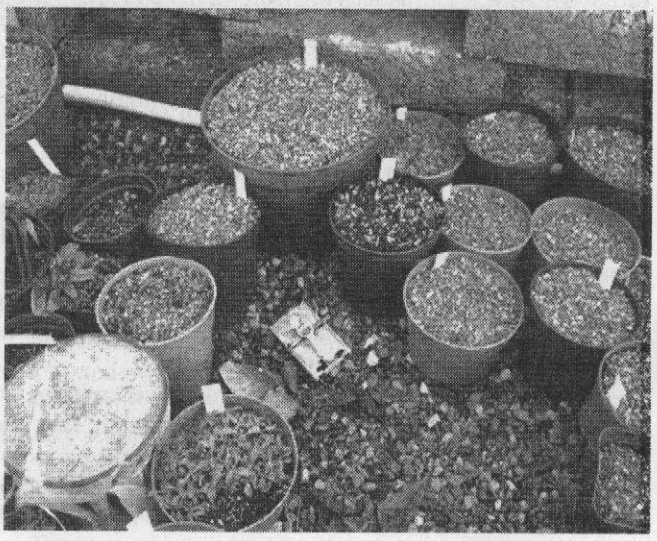
Damping-off

Damping-off describes the wilting and early death of young seedlings. It is caused by parasitic fungi living in or near the surface of the soil.

Crowding of seedlings, high humidity and lack of sufficient aeration all favour damping-off. Remedial measures include ensuring proper ventilation, drying the soil in which the seedlings are growing and sprinkling powdered charcoal on the surface of the soil.

Summer-planted seed always needs to be firmed. Spring planted seed may or may not need it, depending on soil and weather. Summer-planted seed should be covered with a sheet of paper or fine, dried grass clippings to protect it from drying out until germination.

If seeds are planted in a pot, the bottom quarter of the pot should be filled with broken pieces of pottery or gravel to provide drainage.



Label each pot with the name of the seeds planted

If using a seed raising tray cover the bottom of the tray with sphagnum moss. Cover with moist soil and sow the seed thinly.

If more one kind of seed is planted in a container, the seeds should be chosen to germinate at about the same time so that all will be ready for transplanting together.

After the seeds have been placed in rows, sand or fine compost should be spread over them to the correct depth, which is never more than three or four times the diameter of the seed.

Firm the soil and water it, either from above with a very fine spray or from below, by plunging the container into water almost as deep as the soil. When wet patches begin to appear on top of the soil remove the container from the water and drain.

Each pot or container should then be carefully labelled with the name of the seeds planted.

Care of young seedlings

Seed trays may be covered with two or three sheets of newspaper to preserve surface moisture until germination starts, but the cover should be removed occasionally for ventilation or if fungus appears.

The temperature for seed germination may usually be somewhat higher that what the plants will stand after growth has started. Soil should be kept moist, but not wet during this period.

As soon as the first green begins to appear the covering should be removed.

Gradually, as the seedlings sprout and the roots stretch down into the pot, watering may be lighter and less frequent, but the container should never be permitted to become dry.

If seedlings are too thick they will need to be thinned. Occasionally when fine seed is planted, it will come up unevenly, with thick patches in places in the container.

These patches should be thinned with tweezers or excess seedlings cut off with nail scissors so as not to injure the roots. Crowding at this stage will almost inevitably result in damping-off.

Transplanting

When seedlings are 2 to 3 cm tall, they should be transplanted to about 4 cm apart.

The usual rule is to transplant when the first pair of true leaves has formed. By this time seedlings will have developed roots that are in proportion to top growth.

Soil in the new tray may have a small amount of compost mixed with the loam and sand, but the mixture should not be too rich.

If the roots must seek further for food, they will build a strong, healthy root system, which is very important to the plants at this point in their growth.

Some plants benefit from a second transplanting which develops even stronger root systems.

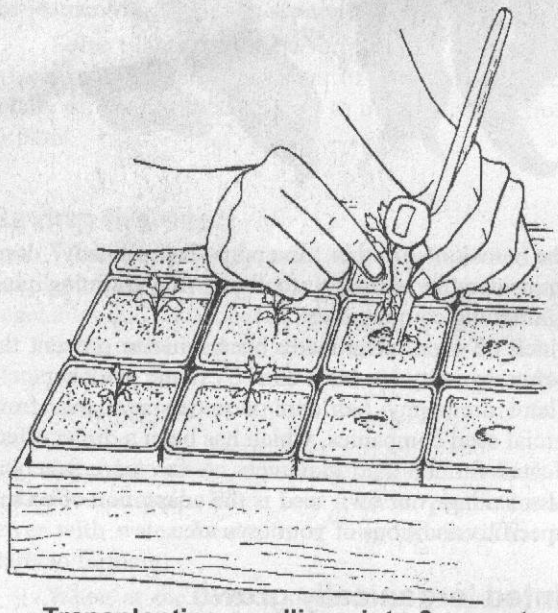
About two weeks before the seedlings are to be planted in the garden, they should begin their hardening-off.

At first they should be set outside during the warmest part of the day. Gradually the period when they are left outside may be lengthened into the cooler parts of the day.

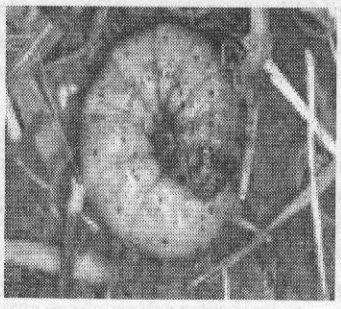
Transplanting should be done on a cloudy day, early in the morning or in the evening when the sun will not shine directly on exposed roots.

If possible, for several days after transplanting, plants should be protected from the direct rays of the sun by newspapers folded in a 'cap' shape or a piece of shadecloth.

Water with a weak solution of liquid seaweed/fish emulsion to protect them from transplant shock.



Transplanting seedlings into 8 cm pots

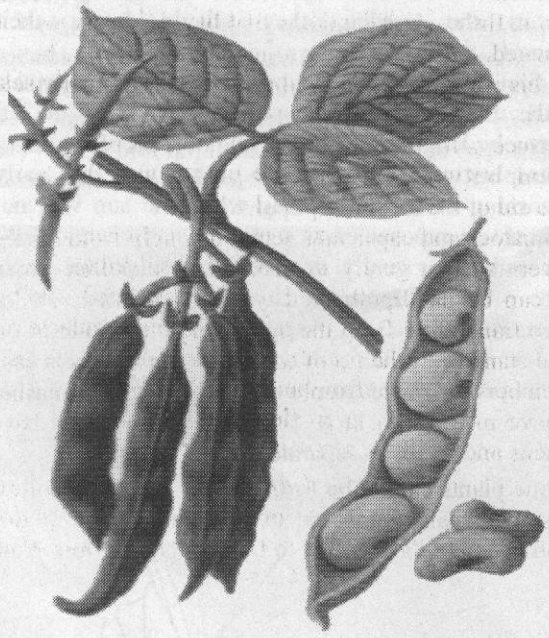


Cutworms

These plump, smooth, variously coloured worms attack a number of garden plants. Young larvae feed on the lower surfaces of leaves, and the older larvae chew through plants stems near ground level.

Hence the name 'cutworm'. Cutworms burrow down several centimetres into the soil to pupate, and grow to be night-flying moths. When disturbed, they typically coil themselves up.

To protect young plants, cutwor collars are easy to make. Use a piece of cardboard or stiff paper about 8 to 12 cm in length and wrap it loosely around the stem of each seedling, sinking it about 3 cm into the soil.☒



Saving Your Own Seed

Many people feel that seed saving isn't worth the bother, although there are many important reasons for doing so. One predominant reason for saving your own seed is the goal of preserving the genetic diversity of our garden crops, and keeping alive the heirloom varieties of by-gone days.

The erosion of this diversity has already done considerable damage to both the farming and gardening communities.

Much of what has already been done to prevent the loss of crop diversity has been done by home gardeners.

There are many heirloom varieties available from commercial seed companies, which has been a direct effect of dedicated farmers and gardeners. A far more practical reason for saving your own seed is the adaptation of a crop to the specific conditions of your own area.

Imprinted 'organically grown'

Generation by generation you will be selecting seed from plants that have performed well in your own garden.

These plants will be imprinted 'organically grown' and will be more resistant to disease and insect attack.

If you decide you would like to save your own seeds, the next thing to think about is which seeds to save. This may at first seem obvious—save the seeds of the plants you enjoy the most.

But first, have a look at all your seed packets. Unless you have been using non-hybrid, heirloom varieties, your seed-saving will involve only non-hybrid, open pollinated varieties.

You may have read that hybrids are not suitable subjects for seed saving, and you may wonder why this is so. As mentioned in the story on seeds, hybrid varieties are the result of plant breeding techniques that sometimes comes down to a set of often highly inbred parent varieties.

These are crossed to produce a new variety that has special characteristics derived from those parent plants.

Because of a poorly understood phenomenon called 'hybrid vigour', these hybrids are more vigourous than the parents, and combine that vigour with the desired traits (disease resistance, early ripening or whatever), of their parents. The combination of genes that occurs when two inbred plant lines are crossed is unique to that generation.

Any seeds produced by such plants, will have a different reshuffling of genes, and cannot be counted on to reproduce the characteristics you found so pleasing in your garden.

They may grow into great plants, but they might not, and as all gardening is a bit of a gamble, it's not really worth the risk.

Weather can't always be predicted, and pests and diseases often vary in severity from season to season. Seeds need to be consistent, so seed saving should not be carried out with hybrid varieties. Hybrid varieties can have their place, just don't bother saving their seeds.

If gardening space is limited, and seed saving is one of your priorities, then the fewer hybrids you grow, the more productive this aspect of your garden will be.

Advance planning

Advance planning can help make the difference between success and failure.

When planning the garden with seed saving in mind, spacing takes on extra importance. It's vital to keep your chosen varieties 'pure'—distinct from other varieties of the same species so as to prevent cross-pollination between them.

Say you have three kinds of tomatoes you can't live without and you want to save their seeds. You need to keep the pollen of any one variety from reaching the others.

In a large garden, you would simply plant the varieties far enough away from each other to minimize or even eliminate cross-pollination.

So, how do you manage the necessary isolation when the plants are growing in a small garden? Most of the plants will be three or four meters apart at most. And for insects as industrious as the bee, this isn't a problem at all.

Obviously one technique would be to plant one variety of a particular crop each season. If you can live with only one type of tomato, then that is a solution. But many people prefer to grow a few different varieties.

Physical barriers

Two other ways of isolating plants are physical barriers and time. A physical barrier can be as elaborate as a wood-framed cage of insect screening, or just a length of screen over a row of lettuce. The more upright the growth habit of the plant, the more likely you will need to build something.

Tomatoes, eggplants, capsicums and peppers can be enclosed in a simple cylinder of screen held together by wires or clothes pegs, with a cap of a similar material on top fastened securely in place.

Low growing herbs and vegetables, such as basil or beans, can be protected by putting insect screening over them and securing the edges.

Crops grown vertically on a trellis or other support require a bit more time and trouble, since covering the entire plant is not practical. For these crops the trick is to just enclose the flowers. If you have some spare scraps of insect screening, cut it into pieces of suitable sizes, wrap it gently and loosely around the flower and tie it with string. Small paper bags can also be used to protect flowers from unwanted pollination.

Basically the goal is to wrap some sort of material around the flowers that will allow for the passage of air but not insects. With proper planning you can make it possible to have time on your side too.

Time can be as effective a barrier to pollination as a cage made of fine wire mesh, and matters of timing can also be used to make physical barriers much more effective.

Plant different varieties

The trick is to plant varieties at long enough intervals that they don't come into flower at the same time, or that any overlap is minimal. Where an overlap does occur, or in areas with short planting seasons, cages or coverings can be used for a short time.

Biennial crops lend themselves especially well to the use of timing to prevent cross-pollination. Some of our favourite vegetables, such as carrots and radishes, are biennials and take two seasons to produce seeds.

This can be a big advantage for the gardener who can't decide which carrot varieties to grow in a small space.

If you like three sorts of carrots (or whatever) you can plant them all, completely harvest all but one variety, leaving the best of the one variety to flower and seed the next year. The following year, another type can be allowed to go to seed.

So, now you have protected the flowers from pollinators, the next challenge is that those flowers need to be pollinated. If the crops are tomatoes, capsicums, beans, or peas this isn't a problem, as these plants are usually self-pollinated.

Lettuce still produces seed if you prevent natural pollination, but you will get more seed if you are able to enlist the aid of the local bee population.

Tomatoes and capsicums seem to benefit from having the flowers shaken gently to distribute the pollen. Other flowers can be hand-pollinated with a fine brush. Pollen should be transferred from the anther (the little bulb at the tip of the stamen) to the tip of the female part. This is easy with members of the cucumber family and the squashes which have medium to large flowers. These plants have the stamens and pistils in separate flowers.

Some plants cannot be fertilised by their own pollen, which is why many members of the plant kingdom rely totally on bees or other insects to transfer pollen from plant to plant.

Saving the seed

Whenever possible, seed should be allowed to dry on the plant. This is important with beans and peas, corn, root vegetables and silverbeet or spinach.

Seed embedded in soft fruit should be left on the plant and not harvested until the fruit is quite over-ripe. Tomatoes, squash, cucumbers and eggplant are treated in this way.

After harvesting, scrape out the seeds which will be embedded in pulp. Place into a clean plastic bucket and cover with water. Leave for a few days until the mixture starts to ferment.

When at the correct stage of fermentation, the pulp should easily separate from the seed. Drain off the water and rinse the seed several times until all the pulp is removed and the seeds are clean.

Drain the seeds thoroughly and spread evenly on sheets of paper to dry. Drying should be done in a warm dry room which has good ventilation. As the seed dries, stir occasionally to prevent mould.

Storage

Most seeds are best stored in glass jars. Storage in the dark is preferable to storage in the light.

Most seed retains its highest viability when stored at humidities below 65 percent. In warm humid weather keep your seeds in the refrigerator.

Seed saving is enormously rewarding and a worthy pursuit in any size garden, whether you want an adapted variety, wish to maintain diversity or both.

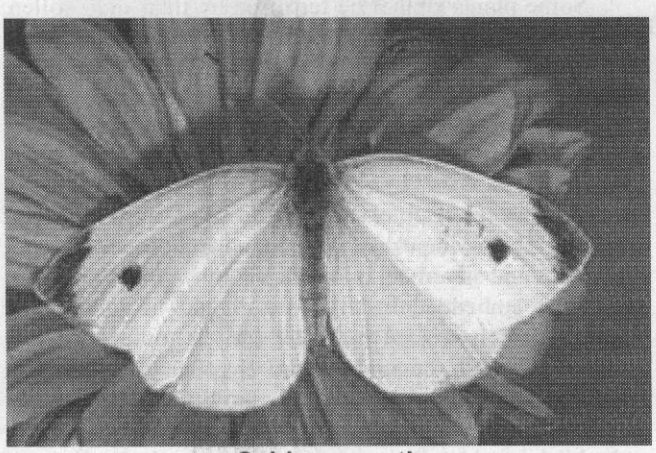
Saving seed can often provide a feeling of completeness. To harvest, store and then plant your seed each season can certainly be one of the many joys of organic gardening.☒

Companion Planting and Crop Rotation

Some plants, when growing close to another species can enhance growth and promote health. Others can do the opposite—growth can be hindered.

It has now been scientifically proved that every plant possesses its own unique active substances and scents (often perceptible to us) which it sheds into its environment.

An insect orientates itself to these scents as they are wafted through the air and seeks out its own special plants on which it feeds or lays its eggs.



Cabbage moth

To us it is a pest, but if there are other plants nearby producing completely different scents and secretions, the insect becomes confused. It is deterred by the resulting combination of perfumes and moves further afield. What goes on at root level, undetected by us, is also important and even decisive in the reciprocal effect of each plant on its neighbours.

The tomato is an outstanding protective plant. Plants at risk can be put between tomatoes rows—the brassica family—cabbage, broccoli, and cauliflower—which are susceptible to attack by the cabbage moth.

Some plants are generally beneficial to the garden because of a particular characteristic of their growth, their scent or their root formation and soil demands.

Among these plants are sunflower, thyme, savoury, borage and other bee attracting plants. There is also a range of insect repellent properties attributed to different combinations of plants.

But there are also combinations of plants that seem to be natural enemies. When planted too close together, the result is often depressed yield of one or both plants.

Traditionally, the vegetable garden was always planted in rows. One of the advantages of planting in rows is that as crops are harvested, the rows become available for fresh sowing and planting.

Planting rows of compatible vegetables and herbs next to each other can enhance the growth of plants, the size of the crop, and give protection from destructive insects.

Plants grown from seed in their permanent position will also be stronger and healthier than plants grown or purchased as seedlings and transplanted into the garden.

The following combinations of vegetable plantings should be avoided:

Beans and onions, cabbages and onions, red cabbages and tomatoes, beetroots and tomatoes, potatoes and onions.

Diversity of plants is the easiest and most effective pesticide and fertiliser the organic garden has—use it liberally.

The following are combinations of vegetables, herbs, and flowers that are mutually beneficial.

Plant	Companion(s) and Effects
Asparagus	Tomatoes, parsley, basil
Basil	Tomatoes (improves growth and flavour): repels flies and mosquitoes
Bean	Potatoes, carrots, cucumbers, cauliflower, cabbage, summer savoury, most other vegetables and herbs
Borage	Tomatoes (attracts bees, deters tomato worm, improves growth and flavour), squash, strawberries.
Cabbage family	Potatoes, celery, dill, chamomile, sage, thyme, mint, pennyroyal, rosemary, lavender, beetroot, onions. Aromatic plants deter cabbage worms.
Caraway	Loosens soil. Plant here and there
Carrot	Peas, lettuce, chives, onions, leeks, rosemary, sage, tomatoes
Celery	Leeks, tomatoes, bush beans, cauliflower, cabbage
Chamomile	Cabbage, onions
Chervil	radishes (improves growth and flavour)
Chives	Carrots. Plant chives around base of fruit trees to discourage insects from climbing the trunk
Corn	Potatoes, peas, beans, cucumbers, pumpkin, squash
Cucumber	Beans, corn, peas, radishes, sunflowers
Dill	Cabbage (improves growth and health), carrots,
Eggplant	Beans

Fennel	Most plants are reputed to dislike it
Garlic	Roses and raspberries, with herbs to enhance their production of essential oils, plant liberally throughout the garden to deter pests
Horseradish	Potatoes (deters potato beetle)
Hyssop	Cabbage (deters cabbage moths), grapes; keep away from radishes
Leek	Onions, celery, carrots
Lemon balm	Here and there in the garden
Marigold	The workhorse of pest deterrents; keeps soil free of nematodes; discourages many insects; plant freely throughout the garden
Marjoram	Here and there in the garden
Mint	Cabbage family, tomatoes, deters cabbage moth
Nasturtium	Tomatoes, radishes, cabbage cucumbers, plant under fruit trees; deters aphids and pests of cucurbits
Onion	Beetroot, strawberries, tomato, lettuce (protects against slugs), beans (protects against ants), summer savoury
Parsley	Tomato, asparagus
Pea	Squash (when squash follows peas up a trellis), grows well with almost any vegetables, adds nitrogen to the soil
Petunia	Protects beans; beneficial throughout the garden
Potato	Horseradish, beans, corn, cabbage, marigold, eggplant (as trap crop for potato beetle).
Pumpkin	corn
Radish	Peas, nasturtium, lettuce, cucumbers; a general aid in repelling insects
Rosemary	Carrots, beans, cabbage, sage, deters cabbage moth, bean beetles and carrot fly
Sage	Rosemary, carrots, cabbage, peas, beans; deters some insects
Soybean	Grows with anything; helps everything
Spinach	Strawberries
Squash	Nasturtium, corn
Strawberry	Bush beans, spinach, borage, lettuce (as a border).
Sunflower	Cucumbers
Tansy	Plant under fruit trees; deters pests of roses and raspberries; deters flying insects, cucumber beetles, squash bugs, deters ants
Tarragon	Good throughout the garden
Thyme	Here and there in the garden; deters cabbage worm
Tomato	Chives, onion, parsley, asparagus, marigold, nasturtium, carrot, Lima beans
Turnip	Peas
Valerian	Good anywhere in garden
Wormwood	As a border, keeps animals from the garden
Yarrow	Plant along borders, near paths, near aromatic herbs; enhances essential oil production of herbs.

Crop Rotation—How it Works

How can a garden be described? Soil, water, air, and plants. A garden is also inhabited by an animal and insect world that lives there in accordance with the laws of nature.

All creatures are more or less useful to us when we are aware of their living conditions and take these into account.

Even 'pests' can be useful as indicators of low fertility, insufficient water, lack of sunshine or other problems in the garden.

Given the opportunity, the garden itself will achieve a balance between the conflicting interests of its plants and animals, its microflora and microfauna.

Crop rotation is a gardening plan in which different crops or ground covers make different demands on the soil each season. Rotation also helps reduce damage by those insects that attack only a few kinds of plants. Growing plants of any kind on the same land year after year produces conditions favourable to the insects that attack that crop.

Crop rotation also plays a vital role in controlling root diseases. In the absence of their host plants, root-dwelling fungi tend to die out in the soil.

Nematodes (microscopic worms that attack plant roots) can be controlled in this way. Also, organisms such as anthracnose (a fungus which attacks avocado's), blackleg in cabbage, blackrot in carrots and fusarium basal rot of onions, peas, and beans plus verticillium wilt of strawberries.

Among vegetables, plants are classified according to their needs.

The first group—Heavy feeders such as corn, tomatoes and members of the cabbage family.

In the next group are the legumes—planted directly after, or the season after vegetables of the first group in order to help the soil recover from the heavy demands of those crops. For example, peas grown during autumn/winter can be following by corn in the spring.

The third group—includes light feeders such as root vegetables and herbs. In a rich soil, the second and third groups may be switched and legumes not planted until last.

Light feeders are great lovers of compost. They also make use of finely ground rock material and make phosphorus, potassium and other trace elements available to other plants.☒

Understanding the Processes of Infection and Disease

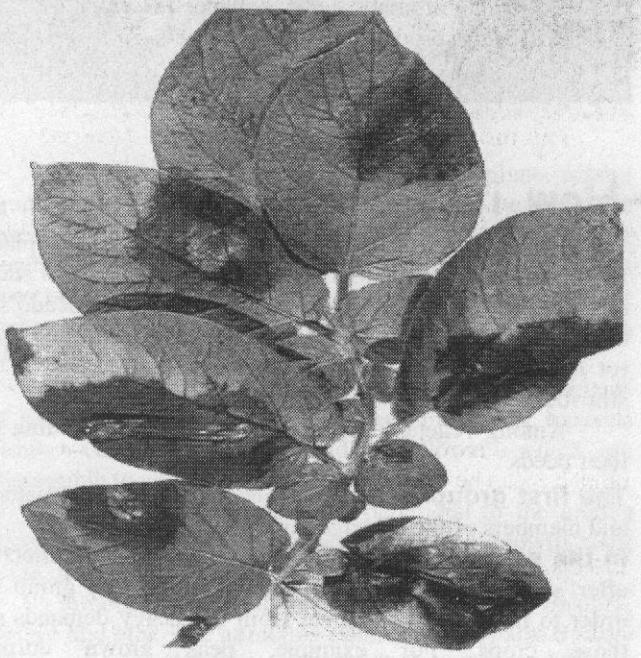
So that we are able to appreciate and understand the problem of disease and insect attack in plants, some recent discoveries in human medicine can give us some assistance and insight.

Many bacteria and viruses can live peacefully in the human body, and under normal circumstances will have few harmful effects.

Their pathological nature only becomes evident, when the infected person or organism starts to suffer from some form of stress.

Most of us can remember times, when during a heavy workload or emotional anxiety, we became ill with the flu or a heavy cold. During these times our natural resistance falls, allowing infective agents to take hold and cause disease.

Exactly the same thing applies to plants. In the 1840s, investigations of the great potato blight in Ireland showed that most healthy potato plants carried the disease, but the blight only manifested itself under unusual weather conditions.



Late potato blight which begins at the leaf margins and later goes dark brown

The long-term evolutionary outcome between host and parasite is an equilibrium of peaceful coexistence. Infection without disease is the norm, rather than the exception.

Same basic principles

These basic principles affect all living things in exactly the same way. In the wild, where animals live close to Nature, a natural selection takes place.

Predators attack and kill weak or sick animals leaving the strong and healthy to reproduce the species.

Unhealthy, weak, or stressed plants have low immune systems—yes plants have an immune system—and will suffer from disease or attack by insects.

Stress in plants can be caused by many different things, such as a period of unusually hot, humid, dry or wet weather. Also growing a plant out of season—like trying to grow spinach or cabbage during hot summer weather.

Or at the opposite end of the scale, planting a corn or tomato crop too late or too early in the season when the weather is cool or cold.

Another example would be planting a tree which can't tolerate wind in a windy area of the garden, or a plant which loves sunshine in a shady area, and vice versa with a shade loving plant.

Taught to destroy insects

Since childhood many of us have been taught than insects are 'pests' that compete with us for the food we eat. Usually we have been taught that these insects must be destroyed using whatever means necessary.

When gardening organically we have to change our view of insects in our gardens. We need to accept them as part of the important contribution they make to our environment and their importance in the incredibly complex ecosystem of which we are a dependant part.

A balanced ecology

As time passes without using pesticides, non-toxic or otherwise, a balanced ecology will develop in the garden where natural predators will increase their numbers.

If a plant is weak or growing poorly it will be attacked by insects. Don't remove the plant. Give the insect a home and a place to reproduce. It will be happy and leave other plants alone.

I have used this method for over 22 years and it really works. I have experimented with spraying the affected plant several times with non-toxic remedies.

Although the resident insects were killed, a short time later, the plant was attacked again.

This led me to the conclusion, that the plant in question was weak or sick in some way, which was not always visible to the naked eye, and was actually inviting the attack.

The life cycle and behaviour of the corn earworm moth is a good example of the close relationship between plants and insects.

Annually this insect destroys over $1 billion in crops. It is among the top ten most destructive 'pests' in the world.

When the female moth emerges from her larval stage into adulthood, her life expectancy is only about eight to 15 days. She immediately gets down to the business of attracting a male moth and finding a host plant such as corn on which to lay her eggs. To make certain the male moth quickly gets to his mate to do his duty, the female emits an irresistible hormone-like pheromone (scent molecules).

When plant tissue breaks down it gives off more ammonia and ethanol that a healthy plant.

Both ammonia and ethanol appear to act as energisers for pheromones. Therefore, sick, weak or diseased plants are more likely to be attacked by insects. A well-nourished plant growing strongly, and in optimum health will have a built-in resistance to disease and insect attack.

One alternative is to do nothing. Let the insect eat all the plants they want, even if they destroy the plants totally.

If this happens you will know that the plants were unhealthy, and for some reason not able to survive in your garden ecosystem.

What you will begin to notice, is that after a few seasons some of your plants will be hardly touched at all.

These will be healthy plants, which are adapted fully to your particular ecosystem.

Predators usually follow pests

Also interesting, is that predators usually follow pests. If you notice a pest infestation, wait a day or two to see if a natural predator comes to your aid.

Lizards, frogs and birds will feed happily on caterpillars, slugs and other 'pests'. Learn to accept some damage to crops—the leaves of silver beet are just as nutritious with a few holes in them!

Vegetables and fruits do not have to be 'perfect'. They are still nourishing, tasty, and enjoyable to eat.

Make time for a daily walk in the garden, or every second day if time is short.

Inspect trees and crops for insect damage or disease because early attention can often save serious problems later.

A foliar spray with seaweed/fish emulsion can often be helpful in restoring plants back to optimum health.

Plant diseases

Diseases of plants are often difficult to identify as the result of the infection can be more visible than the agents themselves.

Viruses

Viruses cause small yields of poor quality, and some strains can quickly kill a plant. Mosaic viruses are so called because chlorophyll is destroyed, causing areas of yellowing on leaves.

The mosaic virus, shown here on a turnip plant is often spread by aphids

Another type of virus blocks up a plant's vascular system, restricting the flow of water and nutrients. Conditions known as leaf curl can result, with symptoms that may include dwarfing or excessive branching.

Methods of control usually involve eliminating the factors that permit viruses to spread. There is little that can be done to restore the health of an afflicted plant.

The removal and burning of infected leaves or branches can be used as a control method.

Bacteria

Bacteria are tiny organisms that cause damage in the following ways: Rots—which involve the decay of leaves, stems, branches and tubers.

Blockage of a plant's vascular system can cause wilting—and galls, that are a result of an over-growth of the affected cells.

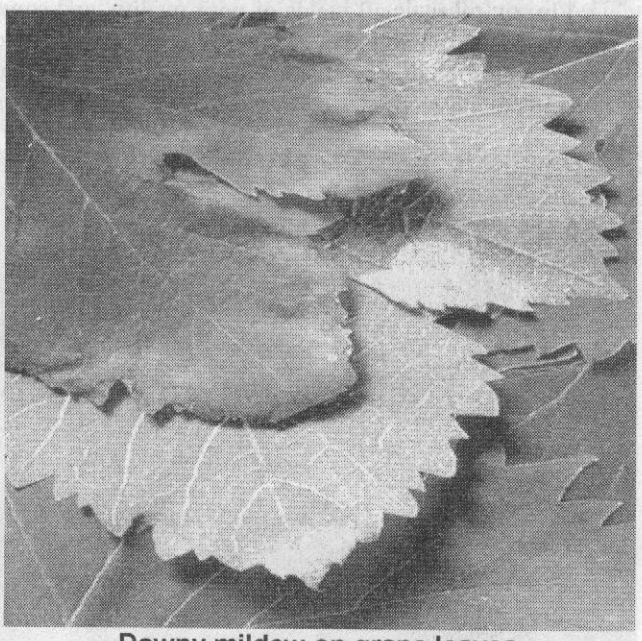
Bacterial problems are encouraged by wet soil, high humidity and high night-time temperatures. The use of disease-free seed and resistant varieties can help control bacterial disease.

Infected plants should be removed immediately from the garden and burnt. Crop rotation can also be a good preventative measure.

Fungi

Fungi are often visible to the eye, with fungus diseases named for their appearance.

Downy mildew

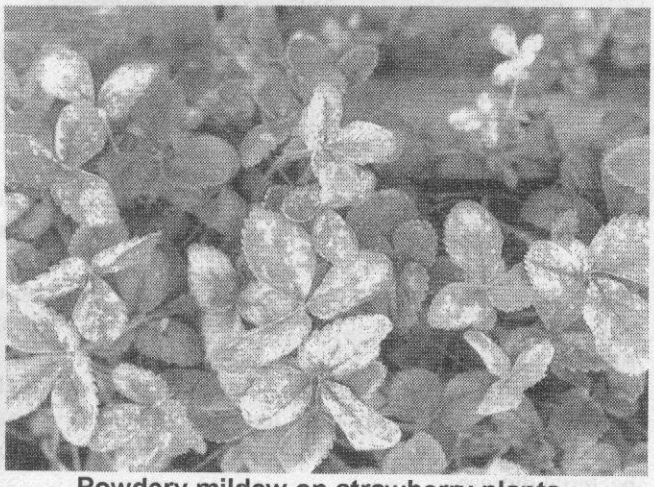


Downy mildew on grape leaves

Downy mildew grows from within a plant and sends out branches through the victim's stomata to create pale patches on leaves.

Powdery mildew

Powdery mildews live on the surface, and send hollow tubes into the plant to suck out nutrients.



Powdery mildew on strawberry plants

This mildew can spread rapidly since the disease cycle can be completed in as little as 72 hours.

However, it commonly takes 7 to 10 days from the time of infection to the development of symptoms and secondary spore production.

Preventative measures

Try to grow powdery mildew resistance varieties. Plant in full sunlight in a well-drained area. Don't crowd plants. Avoid using too much high nitrogen fertiliser which can promote tender leaf formation.

Remove and destroy plants that are infected. Water plants in the morning to give the plants the rest of the day to dry off, discouraging establishment of fungus diseases.

Organic sprays

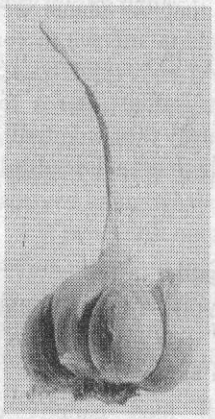
Sulphur is highly effective against powdery mildew. Apply a sulphur-based fungicide at first evidence of mildew, and repeat applications as necessary.

However, sulphur can be damaging to some squash and melon varieties. Another option is to spray once a week with a solution of baking soda.

Baking soda increases the surface pH of the leaf making it unsuitable for the growth of powdery mildew spores. Be sure to spray the undersides of leaves as well as the upper surfaces when using any of these sprays.

Home-made baking soda spray

One teaspoon baking soda, one litre water
A few drops of liquid detergent—which acts as a surfactant and encourages the mixture to stick to the leaves.



Garlic contains high levels of sulphur and a few cloves crushed in water can be used to make a home-made spray.

Other plant diseases

Rust is named for the colour imparted to leaves. Leaf spot causes yellow-green spots. Soil-inhabiting fungi causes damping-off.

Spacing plants to allow for good air circulation can help to control some fungus diseases. Spraying plants with liquid seaweed foliar spray can also be helpful.

Environmental problems

Environmental problems such as heavy unseasonal rain, exceptionally hot sunshine, strong winds and consistent high temperatures can also contribute to the development of fungus diseases.

A soil rich in soil organisms is the best insurance against plant diseases, providing conditions favourable to vigorous growth.

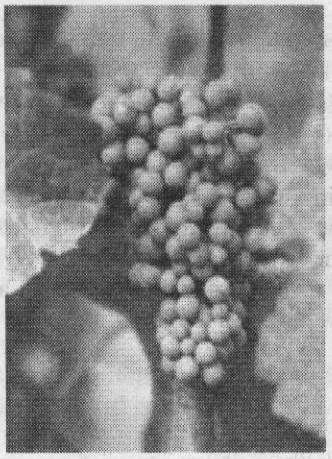
Beneficial fungi and bacteria which feed on destructive species can keep soil bacteria and fungi in balance.

Many diseases of plants can also be eliminated by careful observation and taking appropriate action before the situation gets out of control.

Smokers should not handle plants without first washing their hands because of the risk of spreading tobacco mosaic disease which is often found in tobacco.

To protect tomatoes from viruses, it is best to isolate them from potatoes and cucumbers.

Bordeaux fungicide Discovered in 1882



In Medoc in southern France, many acres of grapes were grown.

But young boys often used to snatch and carry off the grapes that grew by the roadside.

The owners of the vineyards, becoming increasingly annoyed, had resorted to splattering the broad green leaves of the vines with a lime and water slurry to resemble bird droppings. They did this in the hope that it would deter the boys from stealing the fruit.

Some owners, a little more vindictive, added some bluestone, a substance well-known to be poisonous. This blue-white, sickly-looking concoction would stick to the grapes and foliage even through the heaviest rainstorms.

The summer of 1882 was particularly wet and mildew rotted the grapes, threatening to destroy the vines themselves.

Late that season, Dr. Pierre Millardet, a professor of botany, was inspecting the devastated vineyards in the area. He noticed that the few plants near the roadway were healthy, and heavy with well-ripened grapes.

Those further back in the vineyard were defoliated and the grapes were shrivelled, rotten, or unripened.

Dr. Millardet learned of the composition of the concoction that remained splattered on the sound leaves and fruit. During the next two years, he experimented with mixtures of lime, iron, and copper salts, but found the original combination of ingredients worked best.

He then calculated the most effective proportions and published his findings in 1885—naming the new spray 'Bordeaux mixture'.

The new fungicide was later improved with the addition of copper sulphate. Although found by chance, it is still in use today.

Non-toxic fungicides used by organic gardeners are:

Bordeaux mixture

Home made recipe: Stir 90g copper sulphate into 4 ½ litres of hot water and leave overnight.

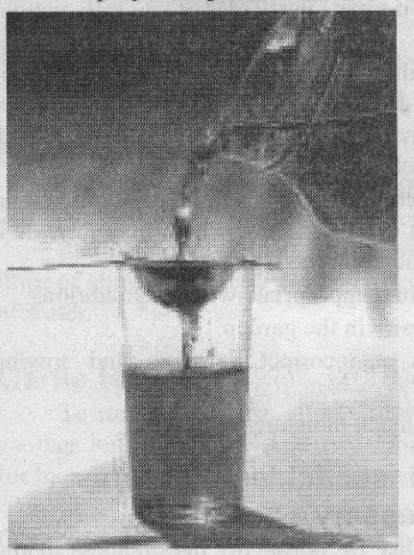
Next day, mix 125g garden lime with 4.5 litres of cold water. Mix with the copper sulphate and use immediately.

Baking soda: For mildews and rusts. 500 g baking soda, 15 litres water, 250 g soap. Mix thoroughly. Can also be used to control scale.

Copper-oxycloride

A commercially available preparation, useful for treating all types of fungus diseases.

Chamomile tea: Make up as a drinkable tea, allow to cool and spray over plants.



Chive tea: For scab and mildew. Use dried chives. Pour 500ml of boiling water over the dried chives and infuse them for an hour.

Strain through an old nylon stocking. Dilute one part spray with two parts water and use.

Epsom Salts—(Magnesium sulphate)

Mix 1 tablespoon into 2 litres of water. Effective against mildews and also has the added advantage of adding magnesium to the soil.

Milk: Use one part fresh milk to nine parts water. This solution is also effective for controlling Red Spider mite.

Potassium Permanganate (Condy's Crystals).

A useful general insecticide and fungicide, acting as a contact poison. Depleted within 4 hours.

Dissolve 10 grams Condy's crystals into 4 litres of water.

Liquid seaweed: Applied in a foliar application is very effective against all types of moulds and fungus diseases.

Vinegar Fungicide

Mix 3 tablespoons of natural apple cider vinegar in 3 litres of water. Spray during the cool part of the day. Use to control black spot on roses and other fungal diseases. Adding 1 tablespoon of molasses to the water will also be beneficial. ☒

Non-Toxic control of Insects

There are many different non-toxic control methods we can use against insects in the garden. Some are commercial sprays and powders, others can be made at home from household ingredients.

Some of the most common causes of insect pest problems in the organic garden are the following:

- Growing a large plot of the same type of vegetable. The pest spends less time searching for an appropriate food source and more time feeding, before reaching maturity earlier and going through more generations in each season.
- Overuse of non-toxic pesticides that kill natural enemies.
- Plants are unhealthy and are unable to resist attack or outgrow insect damage. Plants in poor nutrition are also able to give off chemical pheromones which invite insect attack.
- Removal of natural plant communities, including bushland, weeds or other plants which may provide a habitat for beneficial insects.
- Growing plants in inappropriate weather conditions.
- Lack of biodiversity in the garden.
- Growing plants at incorrect densities and sowing depth.
- Lack off, or too much moisture in the soil.

Use non-toxic insecticides only when absolutely necessary

The following list of non-toxic insecticides should only be used when absolutely necessary. It's important to allow the garden to develop it's own micro-diversity and ecology.

Dipel (*Bacillus Thuringiensis*)

Of the micro-organisms that make insects ill, *Bacillus thuringiensis* is by far the best known. Though safe to humans, it has a devastating effect on moth and butterfly larvae, both of which are prime economic pests.

BT, as it is often called, appears on the market under the name of Dipel in the form of a soluble powder. The powder is suspended in water and sprayed on plant surfaces, where it is ingested by the pest.

The BT spores then germinate into plants that occupy more and more of the victim's body. A toxic crystal is also produced and is thought to be partially responsible for the insecticidal effect.

BT is useful on both vegetable and fruit crops, aiding in the control of a number of well-known pests—caterpillars, corn earworm, peach tree borer, cabbage moth, cabbage looper, and gypsy moth caterpillar.

Rotenone

Rotenone is extracted from the roots of derris plants. This general garden insecticide is harmless to plants, although it is highly toxic to fish and many insects. It is also moderately toxic to mammals, but leaves no harmful residue on vegetable crops. It acts as both a contact and stomach poison to insects.

It is slow acting and, in the presence of sun and air, its effectiveness is lost within a week after application.

Wear a mask during application because rotenone can irritate the respiratory tract.

Rotenone dusts and sprays have been used for years to control aphids, certain beetles and caterpillars on plants, as well as fleas and lice on animals. Use against aphids, thrips and caterpillars.

Pyrethrum

A botanical insecticide derived from the flowers of a species of chrysanthemum imported mainly from Kenya and Ecuador.

The material causes rapid paralysis of most insects, but the insects usually recover unless the pyrethrum is combined with a synergist or other poison.

Pyrethrum mixed with synergists such as piperonyl butoxide or piperonyl cyclonene, which increase toxicity and produce longer residual action is not an allowable input according to National Organic Standards.

However, there are several pyrethrum products available that are certified organic. Use against aphids, thrips, caterpillars, ants, flies, earwigs, cabbage moth.

As pyrethrum also affects beneficial insects it should only be used as a last resort.

Nicotine Sulfate

Nicotine is extracted from tobacco or related *Nicotiana* species and is one of the oldest botanical insecticides in use today.

It's also one of the most toxic to warm-blooded animals and it's readily absorbed through the skin. Wear gloves when applying it, follow label directions and keep pets away from application areas. It breaks down quickly, however, so it is acceptable to use on organically grown crops.

Nicotine sulfate is marketed as a 40% liquid concentrate which is diulted in water and applied as a spray.

Dusts can irritate the skin and are not normally available for garden use.

Nicotine is used primarily for piercing-sucking insects such as aphids, whiteflies, leafhoppers and thrips.

It is more effective when applied during warm weather. It degrades quickly, so can be used on many food plants nearing harvest. It is registered for use on a wide range of vegetable and fruit crops.

Wettable Sulphur

An effective fungicide and miticide. The sulphur interfers with important processes in fungal spores and is noted for its ability to suppress mite populations.

Other non-toxic pesticides

Gardeners have been using soap to control insects since the early 1800s. During the first half of the 19th century, whale oil soap and, more commonly, fish oil soaps were an important part of insect control.

Recent tests indicate that a good quality environmentally friendly dishwashing detergent, diluted with water to a 1 to 2% solution, provides the most consistent control and is easy to mix. There are also soaps available that are specifically formulated to control insects on plants.

Thorough coverage of the plant and repeated applications may be necessary to bring insect populations under control and may damage some plants.

Barrier bands

Barrier bands are wrapped around the trunks of fruit bearing trees to prevent crawling insects and larvae from reaching fruit and foliage.

The insects will hibernate in the bands, which should be removed and burned. (Do not bury or compost).

Tie corrugated paper, cotton, or sacking around the trunk. This is very useful against Codlin Moth.

Clear White Oil

A miscible oil for the control of White Wax Scale, Red scale and other scale insects. Low toxicity, has a smothering effect on scale, eggs, larvae.

It may affect the eggs and larvae of predators. Spray alternate rows in orchards, then reverse the order to allow predators to survive.

Recipes

Ammonia

Liquid household ammonia can be used as a greenhouse fumigant against woodlice, slaters and earwigs.

Sprinkle on the floor, and close up. Can also be used to treat compost heap lice infestations by sprinkling over a little ammonia and covering with plastic for a few hours. **Warning:** it may also kill worms.

Compost tea

Manure and compost tea is effective on many pests because of certain micro-organisms that exist in it naturally.

How to make compost tea

Use any container, but a plastic bucket is easy for the home gardener. Fill half full of well-made compost and fill with water. Leave for 10 to 14 days

Dilute the tea concentrate to approximately 1 part tea to 10 parts water, straining out the solids with old panty hose or cheese cloth.

Spray on the foliage of any and all plants including fruit trees, perennials, annuals, vegetables, roses and other plants, especially those that are regularly attacked by insects or fungal pests.

Compost tea is a very effective control for black spot on roses and early blight on tomatoes.

Garlic/pepper tea

To make garlic/pepper tea, liquefy 2 bulbs of garlic and 2 hot chillies in a blender with a cup of water.

Strain the solids and add enough water to make 4 litres of concentrate. Use 1/4 cup of concentrate per 4 litres of water.

Garlic tea

To make garlic tea, simply omit the pepper and add another bulb of garlic. Add two tablespoons of molasses for more control.

Garrett Juice: (Ready to spray)

One cup compost tea, one large tablespoon molasses, same of natural apple cider vinegar, same of liquid seaweed.

Safe Use of non-toxic insecticides

When it is necessary to use insecticides to protect the garden, use them wisely and safely. The following tips will help you make better use of insecticides.

Inspect the entire garden at least weekly to monitor insect numbers and activity. Pay particular attention to the underside of leaves where mites, whiteflies, aphids and insect eggs occur.

If treatments are applied when an infestation first starts, insect numbers can be maintained at lower levels much more easily.

Apply insecticides to all plant surfaces so an insect anywhere on the plant will be exposed to a lethal amount of the chemical.

Do not apply insecticides during the hottest part of the day. Use dusts only when the wind is calm, or when the wind is no more that 20 kilometres an hour.

Further treatment may be necessary after rain. Apply insecticides only at recommended dosages.

Common pests in the garden

Aphids

Build soil health, release ladybugs, and lacewings (available from the Department of Primary Industries).

Spray foliage with molasses and water before releasing beneficial insects. Spray garlic tea as a preventative. Spray garlic/pepper tea or Garrett Juice if necessary.

Caterpillars

Spray Dipel: Bacillus thuringiensis. Release trichogramma wasps.

Scale

Use 500 g soda, 15 litres water, 250 g soap. Mix thoroughly. White oil can also be used.

Spider mites

Spray liquid seaweed and garlic/pepper tea and release lacewings. Spray Garrett Juice plus garlic for heavy infestations.

Make sure plants are not being watered too much or too little. Use 500 g soda, 15 litres water, 250 g soap. Mix thoroughly.

Whiteflies

Spray a mix of liquid seaweed and garlic/pepper tea or Garrett juice plus garlic.

Rutherglen bug

This grey-brown bug has silvery wings and is 5 mm long. It usually feeds on weeds and grasses in wasteland or along roadsides. However, it will move on to cultivated crops in hot weather when weeds and grasses have dried off. Plants attacked—Grapes, beans, stonefruit, lettuce, onions, strawberries, tomatoes, potatoes, and carrots.

Control: Spraying should be undertaken quickly to minimise losses. Use Pyrethrum insecticide once a week until the insect is under control. Do not spray seedlings.

Erinose mite - lychee

These microscopic mites attack young leaves, shoots, flower buds and fruit. The feeding of young mites on the surface cells stimulates the production of millions of 'hairs' which give the damaged area a velvety appearance.

Control: Spray wettable sulphur at the same rate 10-14 days later. This treatment should kill off any mites present on the tree and future problems are unlikely.

If the tree is already infested, spray with wettable sulphur just before a new flush of leaves is to occur and monthly thereafter until new growth develops without showing any symptoms.

Homoeopathic control

Remove infested leaves and burn with a little wood. Sprinkle the ashes around the base of the tree. Do this two or three times when infestation is apparent.

Fruitspotting bug

This is an Australian native bug, and cultivated trees near areas of bushland are most likely to be attacked.

The adult bugs are green, elongated in shape and about 15mm long. Each female may lay many eggs during warm weather and bug numbers can build up quickly. The nymphs have reddish-black legs and a dark reddish abdomen with two black spots.

Both adults and nymphs suck sap and even a few of them can cause serious damage to macadamia nuts The symptoms vary, but often include nut fall which may be the first indication of an infestation.

On papaws the bugs suck sap from the growing point, leafstalks and young fruit. The fruit usually falls.

Peaches that have been attacked exude gum, and contain gum pockets. Again the fruit usually falls. On avocados the damage of this pest is very like the damage caused by the banana spotting bug.

Plants attacked

Macadamias, avocados, pecans, custard apples, guavas, lychees, passionfruit, plums, peaches, nectarine, persimmons, mangoes, papaw, and citrus.

Control: Spray with Pyrethrum every 10 days until control is achieved.

Controlling Fruit Fly Organically

It is possible to control fruit fly organically. There are two sorts of fruit fly common in Australia, the Queensland fruit fly and the Mediterranean fruit fly. Both have similar life cycles and you are required by law to control them.

Prevention:

In areas with cold winters, prevention may be all that is required. The fruit fly dies off in winter, and garden and orchard hygiene may prevent them from building up to problem proportions until summer crops are harvested.

Even if you have fruit like citrus ripening through winter, prevention should still be the cornerstone of your fruit fly program.

Fruit fly mature mostly in fallen and ripe fruit, but a severe fruit fly problem can be a sign of bad management. Never leave fallen fruit on the ground. Pick it up every day or have chickens or animals browsing under the trees to eat it.

Fruit-fly infected fruit often falls before it is quite ripe. Having it pass through an animal gullet is a simple way of interrupting the breeding cycle.

Don't bury or compost fallen fruit. Stew them, feed them to the chickens or leave them in a sealed bucket under water for three weeks before composting.

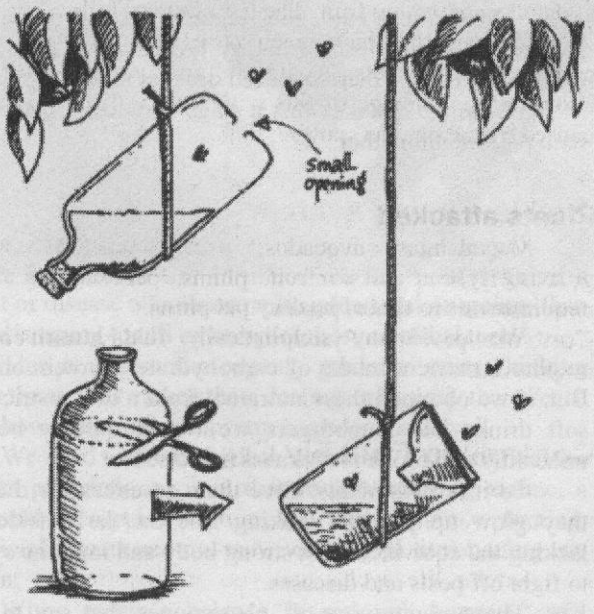
Alternatively place them in a sealed plastic garbage bag, which if placed in the sun for a few days will turn them into anaerobic compost.

In bad fruit fly areas avoid early ripening crops like loquats that may attract the fly to later crops, and avoid maturing varieties which fruit when large numbers of fruit fly are likely to be around.

Be careful of late summer fruits like quinces or figs. They can host fruit fly and provide a 'bridge' for the fruit fly to breed, ready to infect winter crops like citrus.

A 'fruit fly gap' of six to eight weeks may be enough to save later crops from infection.

Fruit fly Traps



Take an empty plastic soft drink bottle, cut off the top at the shoulders, turn it around so that the spout is sticking into the bottle, and tape the edges firmly.
Fill the bottle a third full of bait, cover the hole with mosquito netting and suspend this from trees or stakes in the garden.
Or just fill a plastic bottle half full of bait, hang it spout downwards and punch a few very small holes in what is now the top.

Fruit Fly Baits

When the fruit fly first hatches as an adult it feeds for about a week before mating. It is during this week that baiting can be most effective.

The flies are attracted to moisture, sugars and proteins, and these form the basis of many of the baits.

About 6 weeks to 2 months before expected ripening of fruit, set out a few pilot traps in the orchard to check for sudden build up in numbers. At this point start full scale baiting.

You may need to experiment with different baits and always check that you are not trapping too many orchard predators such as bees, hoverflies and lacewings.

Baits must be checked every week, emptied and renewed—more frequently when population levels are high.

Baits

Love's Bait

1 litre water, 1 1/2 tbsp cloudy ammonia
1 1/2 tsp vanilla essence, 3 tbsp sugar

Stand for 24 hours, dilute at a rate of 3 tsp concentrate: 2 litres rainwater.

Half fill small jars, and suspend approximately three in each tree.

Other variations:

Molasses, water and fruit juice (or milk)
Molasses, flour and water
Urine, sherry or wine
Vinegar and water, vinegar and bran
Wheatgerm and hot water
Honey, golden syrup, sugar, jam and water
Vegemite

Baits are set in the bottom 1/4 to 1/2 of container and suspended in trees. Check regularly, empty and rebait when half full.

'Splash on' Bait

You can make a 'splash on' bait with 50 g of sugar in one litre of water. Add 7 ml of concentrated pyrethrum. Splash it on trees, but don't spray it because the result will be too dilute to be effective.

Apply the mixture two weeks before the known fruit fly dates in your district and then until two weeks after the last fruit has been harvested. Re-apply at least every week because pyrethrum breaks down on contact with light.

Other Controls

Mosquito netting over smaller trees may be feasible in small back gardens.

Remove old, unproductive or diseased trees. Watch loquat and guava trees—they are a link between winter citrus and summer stone fruits. Remove them if you don't need them.

Commercially available 'Dak' pots are available in the eastern states of Australia for Queensland fruit fly. They are only a monitoring tool and will not control the pest. They attract males only and are used to indicate flights and as a guide for when to spray. ☒

Growing Organically—
The Only Way Forward

"If we throw Mother Nature out the window, she comes back in the door with a pitchfork" Author: Masanoba Fukuoka.

This special edition of Warm Earth is a series of single articles, each on an individual aspect of organic gardening.

One article on its own does not make a magazine, but when put together they form a complete publication.

Organic gardening can be viewed in a similar fashion. It's a series of individual steps that, when added together, comprise a natural, holistic approach to gardening.

We have a choice

In conventional gardening nature is seen as inadequate, requiring constant chemical intervention to grow plants successfully. If this were true you have to wonder why the human race did not die out.

After all, people cultivated crops successfully for around 10,000 years before petrochemical fertilisers and pesticides arrived on the scene less than a century ago. For most of human history gardening was practiced organically because there was no other choice.

These days we have a choice and the gardening method we choose to adopt depends on our mindset. We can view our gardens with considerable suspicion, imagining the dark forces of nature lurking in every shadowy corner, ready to emerge at the first opportunity to destroy our handiwork.

If we are of this opinion then we can easily believe that these evil entities can only be kept at bay by the power of various chemical concoctions.

This is not to denigrate those that practice conventional gardening methods. Selling chemicals to grow plants and treat pests and diseases is a billion-dollar industry and the industry spends millions on advertising.

The underlying message in this advertising is that success can only be achieved by providing the soil with a shot of artificial NPK backed up by on-going chemical protection of the plants. Many gardeners accept this as lore because the mantra is continuously repeated.

Plants need a healthy diet

Conventional gardening is all about treating symptoms, or addressing the *effects* rather than the *causes*.

The most effective nutrient provider, pest controller and weed combatant is a healthy soil, but we can't expect commercially driven companies to market this message when to do so would put them out of business.

One thing that organic gardeners and chemical fertiliser manufacturers can agree on is that you can't grow plants without nutrients in the soil.

Conventional gardening regards the soil as an inert sponge; to be filled up to luxury levels with a few major artificial nutrients, then squeezed dry and refilled again.

Hydroponics takes this a stage further by dispensing with the soil altogether.

Soil is a living system

Organic gardeners, on the other hand, see their soil as a living system and the health of this system has similar requirements to that of healthy people.

We could say simplistically that human beings require a nutrient intake of carbohydrates, protein and fat. But, if we obtained these nutrients from a diet restricted to soft drinks and hamburgers we would quickly become unhealthy and prone to sickness and disease.

So it is with plants. Give them an unhealthy diet and they grow up perhaps looking fine on the outside, but lacking the equivalent of a strong body and immune system to fight off pests and diseases.

These plants give off pheromones that say to their enemies, "I'm weak and defenceless. Come and destroy me".

The manufacturers of artificial fertilisers are on a roll here. Sell the gardener unnatural soil nutrients that produce weak plants, then the same gardener has to buy pesticides and fungicides to treat the inevitable problems.

Guess who produces these treatments? Often the same company that made the fertiliser!

Pests are not all bad news

In organic gardening we can even look upon pest attacks as a friendly act. In the same way as lions on the African veldt cull the weaker wildebeest, some insects attack plants that nature knows should not be allowed to set seed and reproduce.

Nature's grand design is to ensure the continuing existence of each plant species and in this natural system only the strong can reproduce. In organic gardening a loss rate of 10% should be regarded as perfectly natural and even beneficial.

We have heard people say many times that they have tried growing organically, but have given up because the bugs ate the plants every time.

If pest or disease attacks are widespread and on-going, then nature is trying to tell us our garden is out of balance.

This is where the organic gardener starts thinking about the *causes* rather than dealing only with the *effects*. Somehow nature's equilibrium has been disturbed.

We need to think about the structure and health of our soil, its pH, drainage, moisture levels, watering regime, a rotational cropping program, companion planting, beneficial insects and the wider ecosystem surrounding our garden.

When nature's balance is restored, harmony will reign again in the garden.

One backyard at a time

If nature is capable of educating us in our own backyard, then what is she telling us as a nation?

The list of ills in the environment seems to grow almost daily. Soil salinity is increasing, soil structure decline is rampant, nutrient levels in conventionally farmed food continue to fall, biodiversity is threatened, the list of endangered flora and fauna grows ever longer, topsoil and excess nutrients pollute rivers and the climate is changing.

If these problems occurred in our own backyard we would readily concede we had a problem that needed fixing.

In a way, our continent can be regarded as one big backyard and nature is saying loudly and clearly, "Australia, we have a problem".

Many quick fixes have been employed since European settlement, including heavy applications of chemical fertilisers, widespread spraying of pesticides, excessive tree clearing and the introduction of biological agents like the cane toad.

We are gradually becoming aware that the perceived benefits were short lived and the side effects more drastic and expensive to fix than the original problem.

Nature is our friend when we work in harmony with her, but she can teach us hard lessons when we work in opposition.

One of the biggest environmental and social problems facing the world today is that people living in modern societies are dependent on others to supply their food.

Only a couple of generations ago it was rare for an Australian garden not to have fruit trees and a vegetable patch, but these days a home with a vegetable garden is more the exception than the rule.

It is amazing how small an area is required to contribute significantly to a household's table. By doing so we are not held to ransom with prices determined by market forces and we are less reliant on pollution-belching semi trailers to deliver produce from across the continent.

When we grow food ourselves we also know it's fresh, nutritious and free from harmful chemical residues.

Aside from the environmental, economic and health benefits that come from growing our own there is the sheer joy of watching the wonders of nature unfold before our eyes.

Growing and nurturing living things in our own gardens is a wondrous and ever-revealing process. A garden is perhaps the only place where the five senses of touch, smell, taste, sight and sound can be stimulated in the one location simultaneously.

If we are unable to grow our own food the kindest thing for the environment is to buy locally produced, organically grown food.

Industrial agriculture and long distance food transportation generate somewhere between 20-25% of all climate destabilising greenhouse gases in the U.S., Canada and other industrialised nations.

At Warm Earth we believe that the future will have to be green or perhaps there won't be one. So, what as individuals can we do? Well, we can start in our own backyards. The restoration of Australia can only be accomplished one backyard at a time, whether our yard is a small suburban block or a million-acre farm. Isn't there a Chinese proverb that says, "The longest journey has to start with a small step"?☒